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Observations of Birds and Mammals

in Central British Columbia

by

J. A. Munro

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OBSERVATIONS OF BIRDS AND MAMMALS IN CENTRAL BRITISH COLUMBIA [1]

By

J. A. MUNRO [2]

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[1] Contribution from the National Parks Bureau, Department of Mines and Resources, Ottawa, Canada.

[2] Dominion Wildlife Officer for British Columbia.

Observations of Birds and Mammals in Central British Columbia

INTRODUCTION

In the following pages are presented the results of a preliminary investigation of wildlife in Central British Columbia carried out in the summer of 1944. The main purpose of the investigation was to evaluate the migratory game bird resources of the region, and for this reason the majority of the localities selected for inspection were those containing lakes, marshes, or other water areas on which waterfowl might be expected to nest, or to concentrate during migration. Thus waterfowl were studied in some detail that included the censusing of populations and the collecting and preserving of the animals and plants representing their food potential. A secondary objective was to assess the bird and mammal population generally, so far as time and opportunity permitted. For this purpose bird specimens were collected where it seemed desirable to establish a record by more tangible evidence than that of observation, and the trapping of small mammals was undertaken as an incidental activity. The present paper deals with observations of wildlife and its environmental background in a number of localities from districts adjacent to Quesnel in the south to districts adjacent to Prince George, Smithers and Hazelton in the north and west. Because the region is so vast and diversified; because each of many places visited might profitably be the subject of an entire season's study, these observations cannot readily be correlated. Neither at this time is there sufficient information to provide a picture of the various biotic areas represented within its boundaries. Nor is it suggested that the annotated list of the birds is complete. It is restricted to the species observed, or recorded on other satisfactory evidence, in various localities of which the majority had not previously been visited by an ornithologist. Their positions are indicated on the map (Fig. 1)

A study of bird populations may be undertaken with the probability in mind that most of their constituent elements are likely to be encountered within a given time, provided sufficient energy is directed toward the attainment of that objective. The study of mammal populations, on the other hand, cannot be entered into with any such assurance. In connection with its larger members--game animals, wolves and most of the fur-bearers--the element of chance largely determines the opportunities for actual observation. Furthermore, even granted the most favourable opportunities, the sum of one summer's observations would be insufficient to provide an adequate picture. Hence in addition to such information as may be obtained from actual sight of the animals, and from the study of tracks and animal 'sign' generally, it is necessary to draw upon the observations and experiences of others.

It is fortunately a fact that mammals in the category mentioned are objects of vital interest and a source of profit to trappers, guides, and woodsmen. Thus a fund of information has accumulated that may be gathered by means of personal interviews, and its value assessed on the basis of probability and the reliability of the source. With this object in mind I made a point of interviewing guides, trappers, ranchers, and the older residents in all the localities visited. The information thus received, supplemented by other information obtained through local game wardens, forms the basis of the section dealing with the larger mammals.

There is no such source of information in respect of the smaller mammals upon which all the valuable fur-bearing species, except beaver and muskrat, largely subsist. For the most part trappers and woodsmen have little knowledge of the former, and few realize that fluctuations in the fur catch are directly connected with a cyclic rhythm of scarcity and abundance in rabbits, mice, and voles. Thus the data submitted on the distribution and current abundance of the smaller mammals were obtained solely by observation and by extensive trapping.

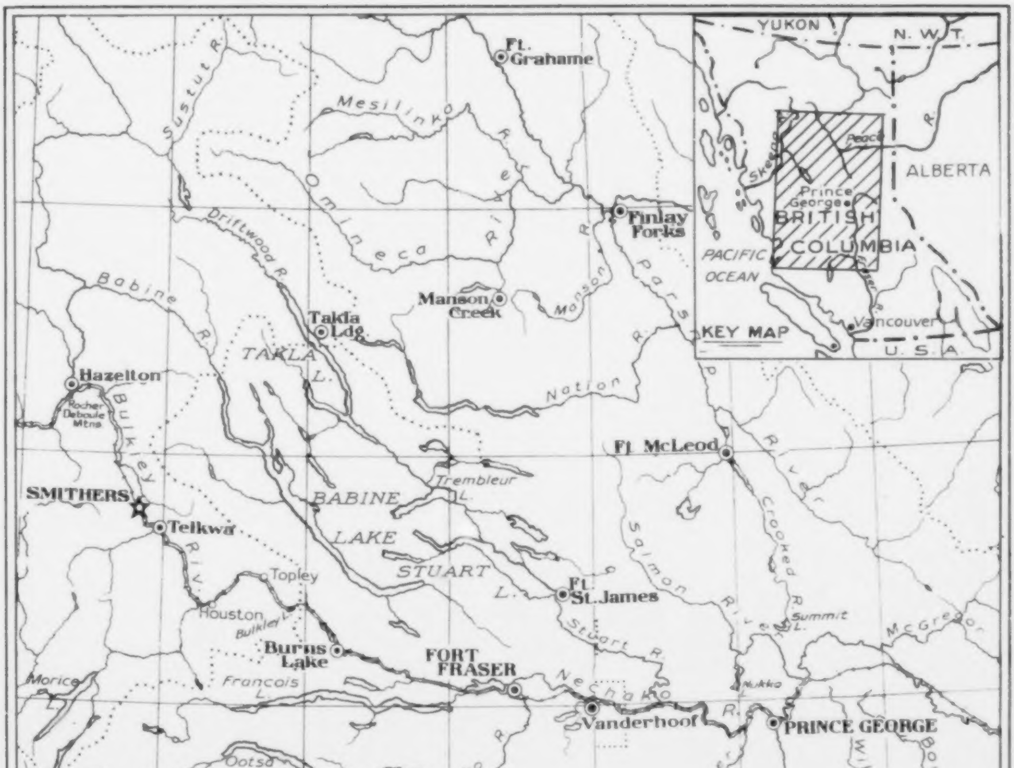

YUKON
N. W. T.
ALBERTA
Peace
Skeena
Prince George
BRITISH COLUMBIA
PACIFIC OCEAN
Vancouver
U. S. A.
KEY MAP
Ft. Grahame
Mesilinka R.
Sustut R.
Omineca River
Finlay Forks
Driftwood R.
Manson Creek
Manson R.
Parsnip River
Babine R.
Takla Ldg.
TAKLA L.
Nation R.
Hazelton
Rocher Deboule Mtns.
Bulkley
Ft. McLeod
Trembleur L.
SMITHERS
Telkwa
BABINE LAKE
STUART L.
Crooked R.
Telkwa Riv.
Topley
Ft. St. James
Salmon River
Summit L.
Houston
Bulkley L.
Stuart R.
McGregor
Burns Lake
FORT FRASER
Morice L.
Francois L.
Nechako R.
Hukko
Vanderhoof
PRINCE GEORGE
Ootsa L.
Nechako R.
Willow R.
Bowron R.
Whitesail L.
Chilako River
Euchiniko Cr.
River
Eutsuk L.
Fraser R.
West Road
Cottonwood R.
Quesnel
QUESNEL
Kimsquit
Dean R.
Nazko R.
Baker Cr.
Quesnel R.
Keithley Cr.
Likely
Ocean Falls
Bella Coola R.
Dean River
Bella Coola
Dean Ch.
Soda Cr.
Horsefly
WILLIAMS LAKE
Burke Ch.
Charlotte L.
Chilcotin R.
Tatla Lake
San Jose R.
Tatla Lake
Hanceville
Rivers Inlet
Chilko R.
Taseko R.
Big Cr.
Tatlayoko Lake
Scale — 50 miles to 1 inch

Fig. 1. Map showing principal localities mentioned in text.

ACKNOWLEDGMENTS

Inspectors R. M. Robertson and Thomas Van Dyke of the British Columbia Game Commission co-operated in the prosecution of this study by supplying data from their files and by arranging for assistance in the field. Game Warden Muirhead of Smithers accompanied me during explorations in his district and his knowledge and experience greatly facilitated the work in that section of the country. Assistance of similar nature also was given by Game Wardens O. Mottishaw of Quesnel, D. Rumieu of Burns Lake, and P. Brown of Vanderhoof.

During the progress of the investigation, information relating to the distribution and status of certain bird and mammal species was obtained from many resident trappers, traders, guides, and farmers. Where such information is used the source is credited in its appropriate place. Mr. J. B. Langston of Smithers, who has practised taxidermy as an avocation during the past 30 years, has various mounted birds, chiefly raptores, in his possession, which are the basis of several records included in the annotated list.

Some of the fishes and most of the plants and the invertebrates referred to in the following pages were identified by authorities as follows: fishes: Dr. Carl L. Hubbs; plants, Mr. A. E. Porsild; amphipods, Dr. G. Clifford Carl; molluscs, United States National Museum; dragonflies, Mr. E. R. Buckle; water bugs, Dr. H. B. Hungerford; fleas and ticks, Mr. George P. Holland; aquatic beetles, Mr. Hugh B. Leech. Grateful acknowledgment is made for all this helpful co-operation.

It is a pleasure also to acknowledge the assistance and the many kindnesses received from Dr. and Mr. G. R. Baker, Quesnel; Mr. Carl Carlson, Quesnel; Mrs. J. Adams, and Miss Grace Wisenden of Prince George; Mr. and Mrs. E. Thompson, Nukko Lake; Mr. and Mrs. Jacob Henkel, and Mr. and Mrs. J. Keefe, Francois Lake; Mrs. R. Clarke, Forestdale; Mr. and Mrs. O. H. Hogg, Bouchie Lake, and Mr. and Mrs. Julius Quanstrom, Puntchesakut Lake.

ITINERARY

Leaving Okanagan Landing by car on May 1, and after completing certain duties in the Lac La Hache Valley, I reached Quesnel on May 5. The following day I proceeded to Puntchesakut Lake, 30 miles by road west of Quesnel, and remained there until June 4. Headquarters were then established from June 5 to June 22 at Bouchie Lake, six miles west of Quesnel. During the remainder of the season the itinerary was as follows: Prince George--June 23; Summit Lake--June 24 to July 2; Prince George--July 3; Nukko Lake--July 4 to July 9; Endako--July 10; Smithers--July 11 to July 17; Hazelton--July 18; Red Rose Basin, Rocher Deboule Mountain--July 19 to July 23; Hazelton--July 24; Smithers--July 25; Bulkley Lake--July 26 to July 31; Ootsa Lake--August 1 to August 3; Francois Lake--August 4 to August 13; Vanderhoof--August 14; Prince George--August 15; Bouchie Lake--August 16 to August 20; Sixteen Mile Lake--August 21 to August 29; Puntchesakut Lake--August 30 to September 6; Lac La Hache--September 7 to September 10; Okanagan Landing--September 11.

DESCRIPTIONS OF LOCALITIES STUDIED

Baker Creek Region

Observations were restricted here to a series of lakes on the 3,000 foot level, and to the woodlands, muskegs , and sloughs adjacent to them. The largest of these lakes, viz., Puntchesakut (altitude--2,950 feet) is approximately 20 air-line miles west of Quesnel. The lakes, as well as numerous small streams having their origin in muskegs and sedge meadows, are tributary to Baker Creek that descends some 1,450 feet in the 20 odd miles of its course to the outlet on the Fraser River near Quesnel. Prominent in the distant landscape west and south of the Baker Creek drainage are low, rounded mountains with summit elevations up to 5,760 feet. The district is reached by the Nazko Road, the greater part of which is bad at any time and deplorable in wet weather. During the period, May 6 to May 12, little sign of life was apparent in deciduous tree growth; the days were cold and cloudy, and during some nights the temperature dropped below freezing point. For the remainder of the month weather conditions alternated between short periods of warmth and sunshine, and periods when rain and cold winds prevailed. On May 11 cottonwoods were shedding their sticky bud sheaths and a mist of green showed on some aspen thickets. By May 30 these trees were in full leaf, alders were half leafed-out, and in the lakes water buttercup, water smartweed, and yellow pond lily had reached the surface.

Coniferous forest: The coniferous forest that covers much of the dry uplands is composed largely of lodgepole pine, Pinus contorta, with a lesser amount of Engelmann spruce, Picea Engelmanni, and Douglas fir, Pseudotsuga taxifolia. Here and there amongst the conifers are groups or islands of aspen, Populus tremuloides. Along the lake shores below the pinelands the small stands of coniferous trees are dominated by Engelmann spruce and black spruce, Picea mariana. Viewed from the lake on a clear morning this condition becomes clearly apparent when slanting sunlight brightens the glaucous green of the spruces into sharp relief against the dark, clear green of the pines behind them. There is little underbrush and the matured forest is open so that travel on foot is easy except where reproduction following spot fires has produced dense thickets. Here and there in depressions are alder copses, none of the trees over six feet in height. The forest floor is grassy with numerous flowering plants, or covered by blueberries of two species, Vaccinium caespitosum and Vaccinium canadense, or by stretches of kinnikinnick Arctostaphylos uva ursi. Single clumps of prostrate juniper Juniperus communis are not uncommon.

Birds commonly seen in this type of forest were Hammond flycatcher, red-breasted nuthatch, ruby-crowned kinglet, golden-crowned kinglet, American robin, hermit thrush, chipping sparrow and Oregon junco. Occasionally a flicker or Canada jay was seen or heard and less frequently a goshawk was sighted.

Aspen forest: These are extensive and some are in nearly pure stands. Thus a sloping hillside on the east side of Puntchesakut Lake is covered with a forest of this type that extends along shore for a mile or so and upward to the summit of the hilltop. In mid-May this forest became a central point of interest in the landscape, when in half-leaf it billowed up from the shore in a cloud of misty green. In some places the trees are tall and without branches for 20 or 30 feet from the base; one of several larger specimens examined measured 46 inches in circumference at a point four feet above the ground. Prominent amongst the birds in the aspen woods were black-capped chickadee, warbling vireo, Tenessee warbler, and orange-crowned warbler

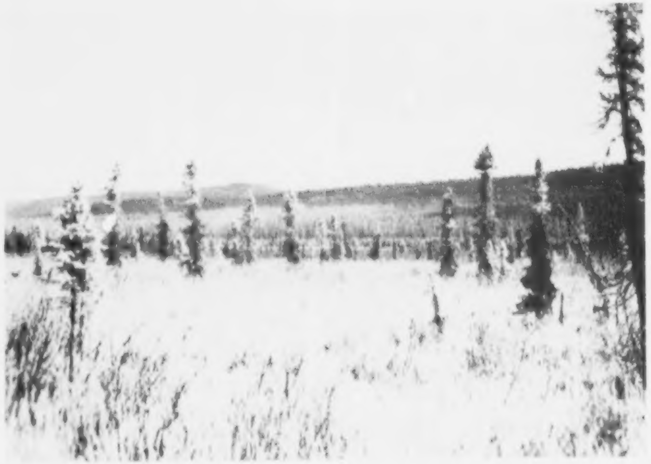
Muskegs: Numerous extensive tracts of muskeg lie between dry ridges covered with lodgepole pine (Fig 2) Black spruce outline their margins and occur also in decreased stature some distance out from shore. The highest and most abundant growth amongst the mosses and grass clumps that dominate the floor is dwarf birch, *Betula glandulosa*, none of which exceeds 12 inches in height. Other less abundant plants observed were Labrador tea, *Ledum groenlandicum*, dwarf raspberry, *Rubus acaulis*, and rosemary, *Andromeda polifolia*.

Sandhill cranes nest on some of these muskegs. An occasional marsh hawk and a few forest birds were seen along their margins but, for the most part, these open territories seemed devoid of bird-life.

Puntchesakut Lake: (Fig. 3): 1 3/4 miles long, 1/4 to 1/2 mile wide. The shores are chiefly hard clay, boulders and gravel except along the soft margins of several sedge meadows; the bottom is hard, the water clear and relatively cold. In May, 1944, the level was reported to be 12 inches higher than normal. Jordan Creek, the principal tributary, originates in a small muskeg lake several miles to the northwest and drains large muskegs on its course to the lake. It has a good flow in early summer, and a gravel bottom, where Kamloops trout and suckers spawn. The lake is drained by Puntchesakut Creek, a sluggish stream that winds through a sedge meadow for a quarter mile or so, then turns at right angles and flows through wooded country to empty into Baker Creek. Puntchesakut Creek is also a spawning ground for the fishes mentioned.

The surrounding forest is composed mainly of conifers mixed with tall aspen on the west, and predominantly aspen on the east approach. On the greater part of the shore the beach is a narrow strip between a rapidly shelving lake bottom and a fairly steep land slope, the base of which is obscured by a riparian growth of alder, willow, and a few black cottonwood, *Populus trichocarpa*. Near the north end of the lake a flat peninsula covered with aspen at its base, and with lodgepole pine of the spreading type on the terminal portion, forms one shore of a marshy bay (Fig. 4). Along this peninsula, and for a short distance on either side, is an open gravel beach, grass-covered above high water mark and dotted with black twin-berry, *Lonicera involucrata*, scopalallie, *Shepherdia canadense*, and other low growth.

Three large hay meadows adjoin the lake, one at the northeast, one at the west and a third, the largest, extends in a southwesterly direction from the south end of the lake for approximately three-quarters of a mile to Tiltzarone Lake (Fig. 5). These, and several smaller meadows, are similar in character, viz.; covered with sedges and grasses of numerous species, and by areas on which low willows and dwarf birch are dominant. All were dry or nearly so in early May and this seems to be the normal condition. Each extends to the lake, and at the lake margin terminates in a narrow marsh of coarse-leafed sedges, spike rush *Eleocharis palustris*, manna grass *Glyceris borealis*, and other aquatics. Beyond are beds of yellow pond lily *Nuphar polysepala*. Water moss is common in such places but there is no round stem bulrush. Along both sides of the largest meadow



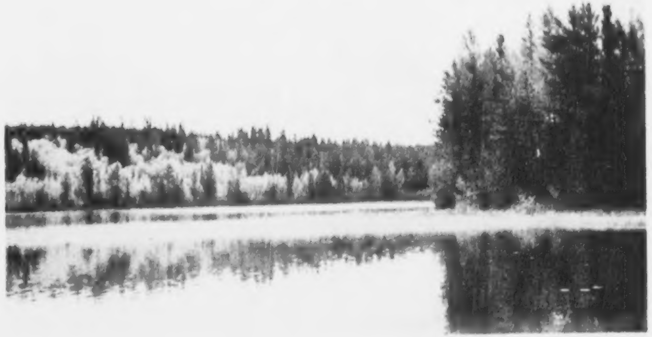
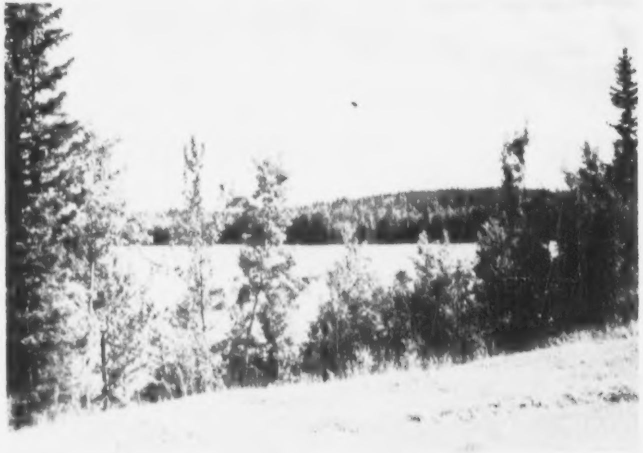


Fig. 2. Muskeg at Puntchesakut Lake.

Fig. 4. Lodgepole pine, spreading type at end of peninsula. Puntchesakut Lake.



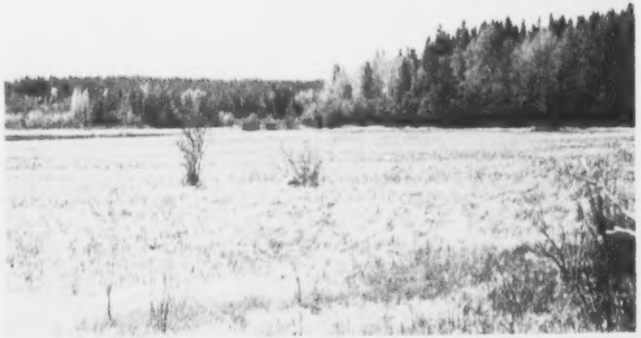


Fig. 3. A portion of Puntchesakut Lake.

Fig. 5. Sedge meadow adjoining Puntchesakut Lake.

referred to, a forest of aspen mixed with spruce and lodgepole pine, and fringed with willows, forms a seemingly straight line of tall trees.

The principal constituents in the supply of animal food available for waterfowl are small fishes and gastropods. The fish population includes Kamloops trout, Salmo gairdneri kamloops, Rocky Mountain whitefish Prosopium williamsoni, fine-scaled sucker Catostomus catostomus, and lake shiner Richardsonius balteatus. Shoals of the latter were constantly in view in the shallows. Snail shells littered some of the beaches, the species identified being Helisoma subcrenatum (Carpenter) and Physella ampullacea (Gould). Other animal food items collected were amphipods, Chironomid larvae, damselfly and dragonfly nymphs. None of these was abundant. The only submerged food plant found in any quantity was a pondweed Potamogeton heterophyllus.

The nesting population, as determined for the entire lake, consisted of two pairs of Holboell grebe, two pairs of mallard, and two or three pairs of greater yellowlegs. There is sufficient nesting cover and food for a much larger population. The lake is a resting and feeding place of some importance for transient grebe, certain diving ducks and gulls. Observations of the numbers and behaviour of these birds are set forth in a later section dealing with the local migration.

Tiltzarone Lake: 1 mile long, 1/4 mile wide, is situated three-quarters of a mile southwest of Puntchesakut Lake. At one time a small stream, passing through the meadow referred to above, drained the lake into Puntchesakut Creek; this stream is now dry. The shores of the lake are boggy with sedge meadow, muskeg and other type of low-lying land, some covered exclusively with thickets of dwarf birch, extending inland from them. An abandoned homestead is situated on the north end of the west side and a settler lives near the southeast corner of the lake. Higher portions of the surrounding land carry the prevailing type of lodgepole pine, Engelmann spruce and aspen forest.

The maximum depth is said to be 30 feet, and the water becomes turbid with algal bloom in late summer. There is reported to be Kamloops trout and suckers in the lake. Along the boggy shores for most of its length is a narrow strip of marsh, comprising sedges, tall grasses, spike rush and horsetail Equisetum sp. On May 15 the flooded sedges, in favourable sunlit places, were about 10 inches in height, and the leaves of yellow pond lily had grown upward to a point about a foot below the surface of the water. Water moss is perhaps the most abundant growth and is important in the economy of the lake. It harbours many aquatic insect larvae; loons and grebe use it for nesting material, and it is the chief constituent in muskrat houses. Amphipods are abundant and this is probably the reason why a relatively large number of diving ducks frequent the lake. The following are counts of the population: May 15; loon, 1 pair; Holboell grebe, 1 pair; horned grebe, 1; mallard, 1; cinnamon teal, 1 pair; lesser scaup duck, 60; buffle head, 16; surf scoter, 11. August 31: Holboell grebe, 3; ring-necked duck, brood of 6; lesser scaup duck, 75+, (adults and young); Barrow golden-eye, 1; white-winged scoter, female and brood of 9; surf scoter, 4.

Food items collected were amphipod Gammerus limnaeus, water bug Notonecta sp., the beetles, Gyrinus lugens LeC., Gyrinus pectoralis LeC., Hydroporus sericeus LeC., and odonata nymphs.

Tiltzarone Lake is one of two relatively good nesting places for diving ducks in the district. The other, an expansion of Puntataenkut Creek known locally as "Bouchie Lake," is described later.

Quanstrom Lake: 1/4 mile long, 1/4 mile wide, is situated approximately one-half mile west of Tiltzarone Lake. The surroundings of both lakes are similar but here the areas of sedge meadow and muskeg are smaller. The shores are part boggy, part clay and gravel. Extending from one lake to the other between two, low, dry ridges is a swampy depression filled with tall willows and other deciduous growth, but there is no water connection between the two lakes. On May 15, one pair of loons and two surf scoters, and on September 2, two loons, one ring necked duck and three unidentified ducks were observed. This lake would seem to be of little value as a nesting ground for waterfowl.

Puntataenkut Lake: 2 miles long, 1/4 to 1/2 mile wide, lies about four miles southwest of Puntchesakut Lake. It is one of the principal sources of Baker Creek and a reservoir for the Quesnel Light and Power Company. A dam at the outlet of Puntataenkut Creek, (the stream that drains the lake), built about six years ago has raised the lake level some eight feet and, as a result, the shoreline spruces along the less sloping parts of the littoral have died (Fig. 6). The surrounding forest is chiefly black spruce, Engelmann spruce and aspen, the latter predominating along the south side where it has replaced a mixed forest burned over some years ago. The lake has five small tributary streams; one of them, Crimmer Creek, winds through a long muskeg before entering the lake. All are said to provide spawning grounds for Kamloops trout that are extremely abundant. A small wooded island is situated near the north end. There are no nesting grounds suitable for ducks. On June 4, waterfowl observed were: loon, 1 pair; Holboell grebe, 2 pairs; surf scoter, 10; herring gull, 2; black tern, 3.

"Goose Lake": This is a sedge meadow occupying most of an 80-acre depression in the forest about one mile south of Tiltzarone Lake.

According to local report it is filled with water in early spring. On May 25 about half of the meadow was under water, and several deep pools persisted through the summer. It is reported to be a feeding ground for Canada geese but none was seen there in spring nor on September 1 when the lake was again visited. Water birds noted on May 15 were: Wilson snipe--at least two pair nesting; greater yellowlegs--1 pair; pectoral sandpiper--15; black tern--2. No water birds of any kind were observed on September 1.

Puntataenkut Creek, north of the Nazko Road: For two miles or so north of the Nazko Road, Puntataenkut Creek flows sluggishly through a wide meadow (Fig. 7); below this it follows a wooded valley to Puntataenkut Lake two miles or so to the southeast. Near the upper end of the meadow the creek expands into a shallow lake, approximately three-quarters of a mile long and half a mile wide, known locally as "Bouchie Lake," (Fig. 8.) (This name is pre-empted by another lake six miles west of Quesnel.) The meadow is covered with grasses and sedges including a large amount of *Carex aquatilis*, and with dense thickets of willow and dwarf birch. On May 15 the sedges showed green where parts of the marsh had been burned; on May 31, the plants, 14 inches or more in height, were in flower. It is not possible to wade this marsh except in a few places; alongside the creek it becomes a floating bog. The narrow parts of the creek are choked with drifted masses of water arum *Calla palustris*, and marsh cinquefoil *Potentilla palustris*.

The lake is shallow, the water clear over a predominantly marl bottom. The shore, except for some hard places along the east side, is boggy and covered with sedges. Along the soft shores, growing on comparatively hard bottom, is an almost continuous marsh of horsetail, the plants about 18 inches in height on May 31. There are no bulrushes either in the lake or along the creek. The greater part of the lake's surface is hidden by a dense growth of pond lily *Nuphar variegatum*, here characterized by large orange-brown blossoms and stout, fleshy stems terminating in broad leaves, the majority erect. This massed growth provides thick cover in which it is difficult to detect any birds that may be occupying it.

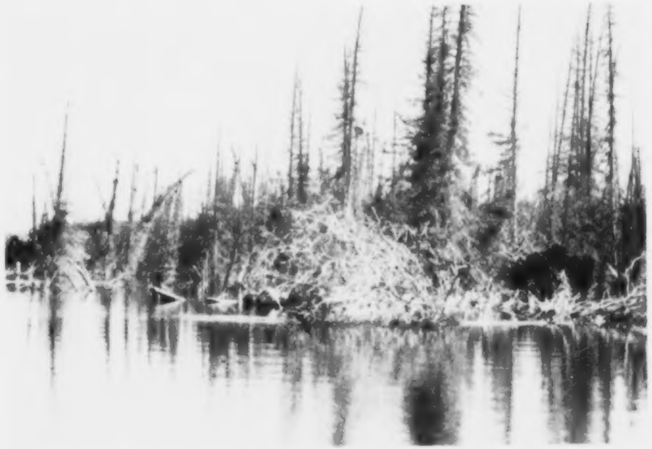
There is little submerged flora, the only species observed being the pondweeds *Potamogeton natans* and *P. nodosus* and a bladderwort *Utricularia* sp., both in small amounts. The invertebrate population in the horsetail marsh, and in the vegetation along the boggy shore, is rich and varied. Amphipods *Gammarus limnaeus*, clams, leeches, water bugs *Callicorixa* sp., aquatic insect nymphs and larvae including bloodworms *Chironomus* sp., caddis Tricoptera, *Dytiscus* sp., mayflies Ephemerida, damselflies and dragonflies were all abundant.

The following census was taken on May 31: Canada goose, 2 pair; mallard, 35+; baldpate, 1 pair; green-winged teal, 1 pair; cinnamon teal, 2; shoveller, 3; ring-necked duck, 4 pair; lesser scaup duck, 7 pair; Barrow golden-eye, 1; buffle-head, 11; American coot, 10; greater yellowlegs, 2 pair; black tern, 10; Holboell grebe, pied-billed grebe and sora were heard.

This is a large population for the region. Probably the abundant animal food compensates for the scarcity of plant food, the lack of first-class nesting cover, and the marl bottom that usually is repellent to waterfowl.

Migration waterfowl: On Puntchesakut Lake a small raft of waterfowl, changing in the number and variety of its members from day to day, was present during the entire time of my stay in the spring (May 6 - June 4) and had commenced to reassemble when I visited the lake again on August 30. This association of birds frequented a relatively shallow portion, 20 to 30 feet deep, in the centre of the lake near its north end; unless disturbed they remained within an area probably not larger than 300 yards by 200 yards. Surf scoters usually were in the majority and the basis of the flock that appeared to attract many other transient waterfowl. The scoters could be seen diving for food, and undoubtedly this portion of the lake,which was frequented constantly, provided an adequate food supply, possibly in the form of gastropods. However, as I was not successful in collecting any of the ducks, this assumption was not verified. From shore it was not practicable to identify all of the various species that made up the flock but on several occasions this was done at close range on the lake. Thus on May 11,with wind and light favourable, I succeeded in coming within 75 yards of the nearest ducks before any took alarm. The flock, spread out over a space of perhaps 200 yards by 20 yards, consisted of the following species in the numbers indicated: Holboell grebe, 6; horned grebe, 17; western grebe, 2; canvas-back, 4; greater scaup duck, 8; buffle-head, 4; white-winged scoter, 30, surf scoter, 78; herring gull, 3; short-billed gull, 7. Herring gulls were the first to rise, followed shortly after by small lots of scoters. The grebe dived. The short-billed gulls permitted an approach as close as 30 yards.

The peak of this migration was reached on May 24. On the morning of that day, with light favourable, and only a slight ripple on the water, I again approached close to the birds. Scoters were congregated in two flocks about 50 yards apart, one composed of 23 white-winged scoters and 12 surf scoters, the other of 37 surf scoters. Most of the surf scoters were in pairs. Strung along the flanks of both flocks were 31 western grebe and, slightly apart from them, 12 Holboell grebe. The grebe rose as I drew near and, after some preliminary awkwardness in rising, ascended steeply--some to circle in swift flight as ducks do, then alight again not far off. Shortly afterward the ducks began to rise, first the white-winged scoters, then the paired surf scoters. At 4:00 p.m. the main flock was assembed in a short line two to six abreast, and all but a few of the ducks were asleep. When I drew near



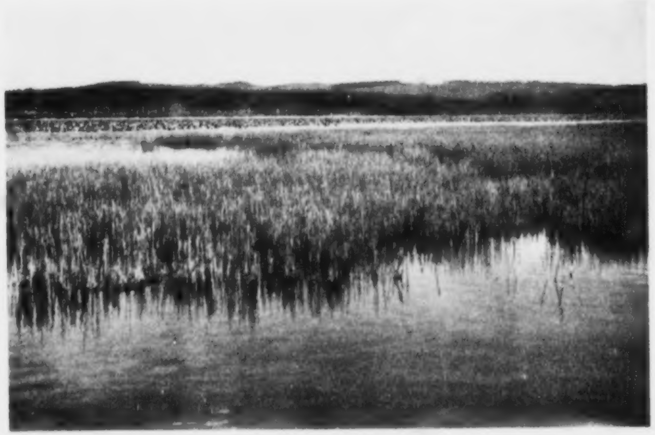
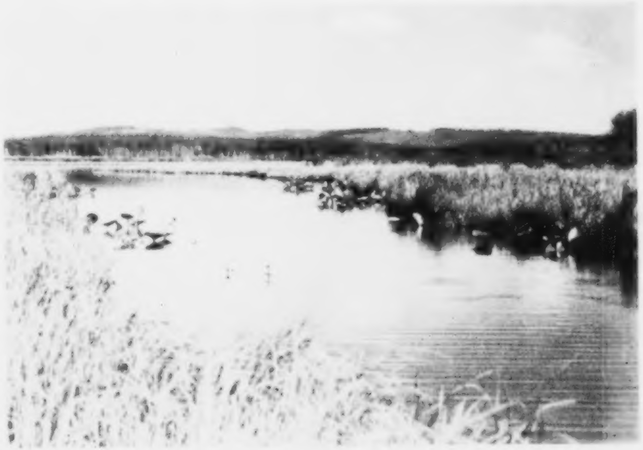


Fig. 6. Flooded spruces Puntataenkut Lake.

Fig. 8. Horsetail marsh on expansion of Puntataenkut Creek.



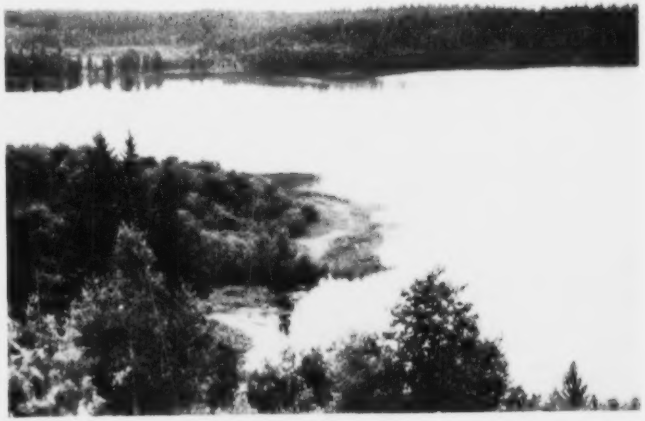


Fig. 7. Puntataenkut Creek, lake in distance. Note erect habit of yellow pond lilies.

Fig. 9. Bouchie Lake; willow thickets bordered by cattail and round-stem bulrush marsh at centre.

them the ducks began to move and the line lengthened so that it became possible to make an accurate count, viz.; 74 surf scoters and six white-winged scoters. Others were together in smaller flocks, the grand total being 100 surf scoters and 37 white-winged scoters. A male old squaw that had arrived during the day flew restlessly from one flock to another and called repeatedly. A number of the western grebe and Holboell grebe and two-horned grebe were still present.

It was observed on August 30 that waterfowl again were frequenting this feeding ground. On September 3 the following birds were present, namely, 25 Holboell grebe, 2 western grebe, 2 Barrow golden-eye.

Migration, land birds: From May 6 to May 11, a period of cold, cloudy weather with rain or snow, a small but steady migration followed the shores of Puntchesakut Lake, the species observed in the largest numbers being ruby-crowned kinglet, Audubon warbler, Wilson warbler and white-crowned sparrow. The period May 12 to May 17 was generally fair but in spite of the favourable condition few birds passed through, at least in the daytime. On May 18, a cool, cloudy day with strong southwest wind, a slight increase in numbers became apparent and the first warbling vireo was recorded. On the following day, with similar weather conditions prevailing, the migration increased considerably. Orange-crowned warblers became conspicuous, and the first western tanager appeared. The migrating birds were most conspicuous along the borders of the aspen woods that were then in about quarter-leaf. The migration continued during the next 10 days; each of the small bands of birds that came under observation contained a few ruby-crowned kinglets and Audubon warblers, indeed there appeared to be a continuous but diminishing migration of these two species during the entire period of observation. The first solitary vireo was recorded on May 20, the first Tennessee warbler on May 27, and the last Wilson warbler on May 30. By June 1 very few birds could be identified, by their behaviour, as transients.

The period August 30 to September 6 was fair and warm. The greater part of the summer populations of small land birds had left. A migration composed largely of red-shafted flicker, American robin, golden-crowned kinglet, ruby-crowned kinglet, Audubon warbler and Oregon junco was in progress.

Comparison with the Cariboo Parklands: It may be of interest compare the Baker Creek region with the Cariboo Parklands to the south. Open park-like lodgepole pine forests are common to both, and the lesser flora associated with them is similar. One important distinction, however, is that blueberries of several species are abundant in these northern woods and absent from similar places in the south.

The grasslands type of terrain, characteristic of the Cariboo Parklands, is not represented. There are no alkaline ponds, nor marshes dominated by round-stem bulrush; instead are muskegs with a flora made up in part of species which in Southern British Columbia are restricted to a sub-alpine habitat. The presence of water arum so far south is observed with interest. The difference in water habitat is associated with a difference in bird-life. Such species as blue-winged teal, redhead, canvas-back, ruddy duck, yellow-headed blackbird, long-billed marsh wren, all common species in the south, are not represented in the nesting population. The relative scarcity of crows, Brewer blackbird, red-winged blackbird, vesper sparrow and red-eyed vireo and the absence of western meadowlark, mountain bluebird and song sparrow is to be noted.

Quesnel Region

Upon leaving the comparatively dry uplands of Baker Creek for the region adjacent to Quesnel it is at once apparent that different climatic conditions prevail in these lower valleys. Engelmann spruce is the most abundant conifer; in places Douglas fir grows tall and straight, the lower 30 to 60 feet without branches, but deciduous forest predominates and extends nearly to the summits of some of the high ridges. In addition to the familiar aspen and black cottonwood, some of them along the river bottoms being exceptionally tall, are stretches of woodland dominated by western birch *Betula occidentalis* and mountain birch *Betula fontinalis* with lesser amounts of wild cherry *Prunus emarginata*, black hawthorn *Craetagus Douglasi*, mountain ash *Pyrus sitchensis* and high bush cranberry *Viburnum opulus*. In these woods, deep in humus, is a vigorous undergrowth of thimble berry *Rubus parviflorus*, rose *Rosa* sp., wax berry *Symphoricarpos racemosa*, tall fern and flowering plants--the general picture being reminiscent of the Columbia Forest Biotic Area. The precipitation is less than might be expected in view of the floral conditions, the average for a 10-year period at Quesnel being 15.51 inches--only slightly higher than that at Vernon, Okanagan, for the same period, viz., 15.24 inches. Perhaps the richness of the vegetation is due in part to the influence exerted by the Fraser River. For example, it was observed that heavy fogs lasting for several hours in the early morning were not infrequent and it may be that moisture conveyed thus to the adjacent slopes and valleys is a factor favouring luxuriance in the vegetation. Along the valleys of the tributary Quesnel River and Cottonwood River the same forest type associated with tall undergrowth prevails.

Floral differences between the Baker Creek and Quesnel regions have been noted. There are differences in the bird populations also. Western meadowlark and mountain bluebird occur along the river bottom, tree swallow, cliff swallow, rough-winged swallow are conspicuous; in the deciduous woods Magnolia warbler, water thrush and redstart are abundant; the hermit thrush to a large extent is replaced by the olive-backed thrush.

Bouchie Lake: 1 1/2 miles long, 7/8 mile wide, lies in a narrow valley six miles west of Quesnel and at an altitude approximately 500 feet higher. It drains into the Fraser River and is fed by Bouchie Creek, the headwaters of which is Milburn Lake about two miles to the southwest. Bouchie Lake is fairly deep with shoreward shallows and a clay, sand and gravel bottom, except in several marshy areas where this is overlaid with dessicated vegetation. On the west side low hills, covered with mixed forest in which aspen and western birch are prominent, rise in easy gradients. The summit of one such hill comprises a wide flat of aspen and lodgepole pine forest and some grasslands about 300 feet above the lake. Here is an abandoned homestead (Fig. 10) and in the distance Baldy Mountain is prominent. Along the bottom of the hills a shoreline forest is notable for the height, girth and straightness of the aspens that form its chief constituent. It is notable also for the variety and vigour of its shrub and ground flora that include highbush cranberry, *Viburnum pauciflorum* and *Viburnum opulus*, rose *Rosa blanda*, thimble berry *Rubus parviflorus*, black twin-berry, soopolallie, waxberry, birch-leaf spirea *Spiraea lucida*, the ferns *Athyrium Filix femina*, *Dryopteris austriaca*, *D. Linneana*, *Botrychium virginianum* and the following flowering plants: tiger lily *Lilium parviflorum*, mitrewort *Mitella nuda*, twisted stalk *Streptopus amplexifolius*, wild lily of the valley Maianthemum canadense, false Solomon's seal *Smilacina amplexicaulis* and *S. stellata*, meadow rue *Thalictrum* sp., bane berry *Actaea rubra*, wild sarsaparilla *Aralia nudicaulis*, hound's tongue *Cynoglossum boreale*, enchanter's nightshade *Circaea alpina*, bunchberry Cornus *canadensis*, blueberries and kinnikinnick. Most of these were in flower during the cool, moist days of June, and in late August the vivid coloured fruits of many were equally conspicuous.

At the upper end of the lake, along the north and northwest side, flat meadowland is separated from the shore by a wooded strip in which tall willows, some of them 10 to 12 inches in diameter, predominate. To the west are open aspen woods and to the east the deciduous growth merges with a stand of black spruce. The soil in these damp thickets is deep and rich and a marginal strip cleared several years ago has produced a rank vegetation of tall fern, nettles and cow parsnip *Heracleum lanatum*, that concealed much of the debris left by the clearing. Cow parsnip in mid-June was 18 inches in height and in August, when the dead flower stalks stood high above other vegetation, it was noted that an average growth of six feet had been reached; one specimen measured seven feet nine inches. Here also were tall blue larkspur Delphinium scopulorum and, in the moist thickets, jewel weed Impatiens noli-tangere. This jungle of vegetation and the adjacent tall willows was occupied by a large population of land birds as testified by a census made on June 6 - June 8 within an area roughly 100 yards by 600 yards, or about 12 acres. The census follows: Rufous hummingbird, 5 pair; red-breasted sapsucker, 1 pair, kingbird, 1 pair; alder flycatcher, 3 pair; crow, 3 pair; black-capped chickadee, 2 pair; olive-backed thrush, 2 pair; ruby-crowned kinglet, 1 pair; red-eyed vireo, 1 pair; warbling vireo, 1 pair; Audubon warbler, 2 pair; water thrush, 1 pair, Macgillivray warbler, 1 pair; yellow-throat, 2 pair; redstart, 6 pair; song sparrow, 10 pair. Excluding the crows, 3 pair of red-winged blackbirds that were nesting in the adjacent cattails, and 5 cedar waxwings seen there on June 7, this works out to a per acre population of 3.2 pairs.

Bouchie Creek reaches the edge of this flat through a narrow valley, descending 300 feet in the last three-quarters of a mile. The stream cuts through the flat, widening to a maximum of six feet, and flows over a gravel bottom between low cut banks and under tall alders. Here also undergrowth is heavy and ferns reach a height of five feet.

Along the shore in front of the willow thickets are two marshes each about 200 yards long and 20 to 50 yards wide. These are of similar character, viz.; inshore a boggy strip 20 to 30 feet wide covered by sedges including Carex aquatilis and C. rostrata, bur-reed Sparganium multipidunculatum, whitetop Fluminea festucacea, and Scirpus microcarpus. (In late summer the inner edge of the marsh was bright with bur marigold Bidena cernua.) This open, boggy ground is succeeded by a strip of varying width in which cat-tail, Typha latifolia, is the dominant growth, and this in turn is succeeded by an open marsh of round-stem bulrush Scirpus acutus. Finally along the outer edge, a belt of pond lilies pattern the surface for a width of 50 feet or more. Between these two marshes, for a distance of approximately a quarter of a mile, are several areas where round-stem bulrush is the sole emergent growth, and stretches of open water over a hard sand and gravel bottom extend to a narrow beach along the foot of a low bank.

The outlet is at the southeast corner of the lake and from there, for a mile or so, Bouchie Creek winds through meadow land of a type less open that that described above. Along the lake at this point is a narrow marsh of round-stem bulrush. There are no cattails there.

The lake contains extensive charophyte meadows and an abundant aquatic flora, including water smartweed Polygonum natans, hornwort *Ceratophyllum demersum*, arrowhead *Sagittaria cuneata*, water milfoil *Myriophyllum exalbescens*, sago pondweed *Potamogeton pectinatus* and the pondweeds *Potamogeton natans*, *P. gramineus*, *P. richardsonii* and *P. zosteriformis*.

On June 8 none except *Potamogeton natans* had reached the surface. In late August the shallows were filled with a dense vegetation, and duckweeds, *Lemna minor* and *Spirodella polyrhiza* spotted the water in the bulrush marshes.

The invertebrate population also is varied and abundant. Amphipods *Hyalella azteca* are numerous in the *Chara* meadows, and amongst the pondweeds are great numbers of caddis larvae, mayfly, dragonfly and damsel fly nymphs.

On a single bulrush stem 110 nymph cases were counted and adults of the damsel flies *Ischnura perparva* Selys and *Lestes dryas* Hagen were collected. Molluscs were plentiful, the following being identified: *Lymnaea stagnalis jugularis* Say, *Gyraulus vermicularis* (Gould), *Pisidium vesiculare* Sterki and *Pisidium compressum* Prime. Items identified in the fish population were Kamloops trout, fine-scaled sucker and lake shiner.

Bouchie Lake has sufficient cover and food to support a sizeable waterfowl population; nevertheless, the 1944 population proved to be very limited indeed, namely, one pair of loons, one pair of Holboell grebe, one brood of Barrow golden-eye and one brood of mallard.

Milburn Lake: 1 mile long, 1/4 to 1/2 mile wide, the headwaters of Bouchie Creek, 9 miles west of Quesnel. This is an irregular-shaped lake with narrow channels between several large islands leading to open stretches of water that are not visible from the main lake. The surrounding forest on mainland and islands is birch, willow, alder, black spruce, aspen and black cottonwood, some of the latter on the mainland shore being exceptionally tall. The main lake is deep with a sand and gravel shore, bordered by a strip of round-stem bulrush, *Scirpus acutus*, manna grass and sedges. The main channel, leading to the more secluded portions of the lake between islands and mainland, passes through a bulrush and sedge marsh about 200 yards wide. All this part of the lake--the channels, the open ponds and numerous marshy bays--is shallow with the surface more or less covered by yellow pond lily leaves. Along one narrow bay, which penetrates the forest for more than 100 yards, tall cottonwoods growing close to the water's edge provide almost constant shade; at the bay's entrance a large bed of arrowhead dominates the bottom vegetation. At other places are strong growths of mare's tail *Hippurus vulgaris*, bladderwort, water buttercup *Ranunculus Gmelini* and the pondweeds *Potamogeton richardsonii* and *P. gramineus*; in the main lake are several *Chara* meadows.

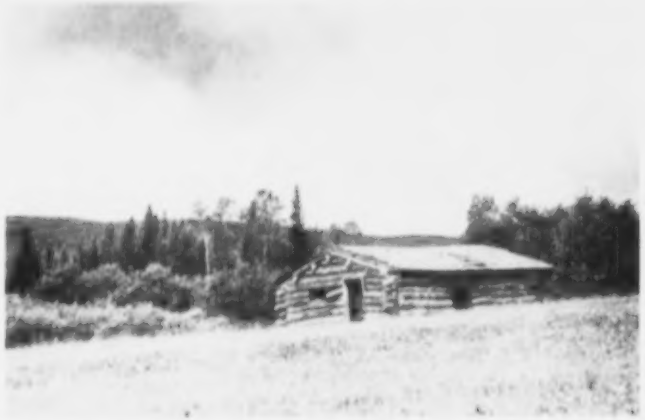
There is an abundant invertebrate life including numerous leeches, the snails *Lymnaea stagnalia jugularis* Say, *Helisoma subcrenatum* (Carpenter), and the amphipods *Gammarus limnaeus* and *Hyalella azteca*. Caddis larvae *Polycentropus* sp. are unusually plentiful and the following beetles were collected: *Gyrinus minutus* LeC., *Gyrinus pectoralis* LeC., *Hygrotus punctatus* Say, and *Thermonectus* sp. larvae.

Red-legged frogs were conspicuously abundant and many used lily pads as resting places (Fig. 11). The lake contains Kamloops trout and some specimens weighing five pounds and over have been taken.

Milburn Lake apparently has all the elements necessary for a large waterfowl population but as observed on June 11 this was limited to the following, viz.: loon, 1; Holboell grebe, 1; ring-necked duck, 6; buffle-head, 1 pair. Several pairs of red-winged blackbirds were nesting in the rushes.

Dragon Lake: 3 1/4 miles long, 1 mile wide, situated in a valley lying north and south on the east side of the Fraser River about three miles southeast of, and at an altitude 500 feet above, Quesnel. The surroundings are deciduous forest mixed with Engelmann spruce, meadow land and cultivated fields. The shores are part sand and gravel, part marl. Round-stem bulrush, *Scirpus acutus*, is established along most of the shoreline in a narrow belt of open growth or in marshes 50 yards or more in width. Here and there also are small cattail marshes. Several peninsulas covered with low willow and aspen terminate in marshes, and in one of these a bed of tall reed grass *Phragmites communis* is an unusual feature. Three hundred yards or so from the tip of one peninsula is an island of several acres grown up with sedges including *Carex aquatilis*, low willows and silverberry *Eleagnus argentea*. The water is clear and of considerable depth except close in shore. In the shallows are meadows of *Chara* and *Nitella*; whether or not these extended into deeper water was not determined. Submerged vegetation includes bladderwort, water smartweed, water buttercup *Ranunculus* sp., sage pondweed and the pondweeds *Potamogeton richardsonii*, *P. natans*, *P. filiformis*, and *P. gramineus*. Outside of the marsh areas on the east shore for half a mile or more is a belt of yellow pond lily.

Insects and other invertebrates appear to be present in only small numbers, dredging with a wire net amongst the vegetation produced only a few mayfly and damselfly nymphs, water mites, bloodworms and the amphipod *Hyalella azteca*. At one time snails and small clams had been abundant, and in clear shallows can be seen deep deposits of their whitened shells, apparently quite old and, although mainly pulverized, some still are intact. Stirring of the soft marl bottom caused dozens of the small shells to rise to



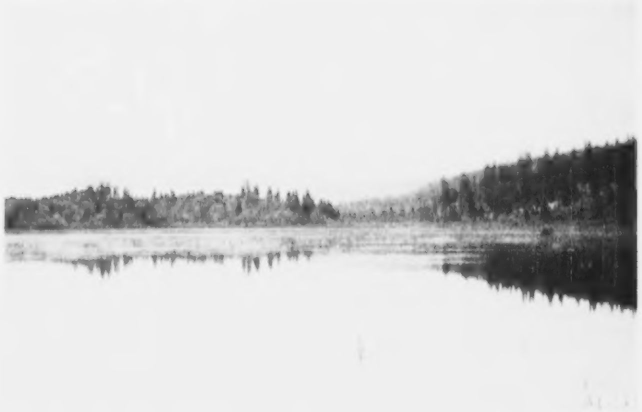
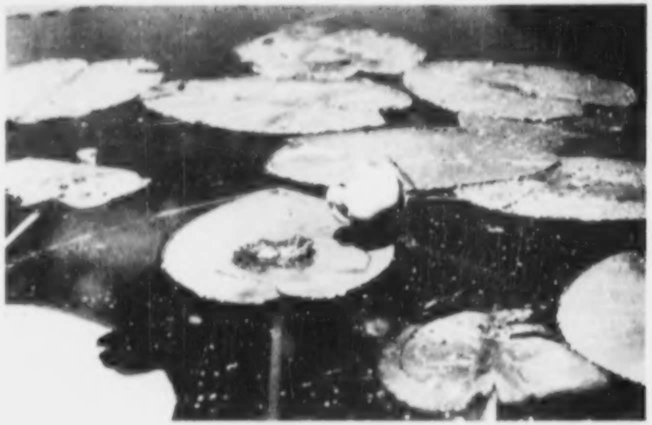


Fig. 10. An abandoned homestead on flat above Bouchie Lake.

Fig. 12. Dale Lake.



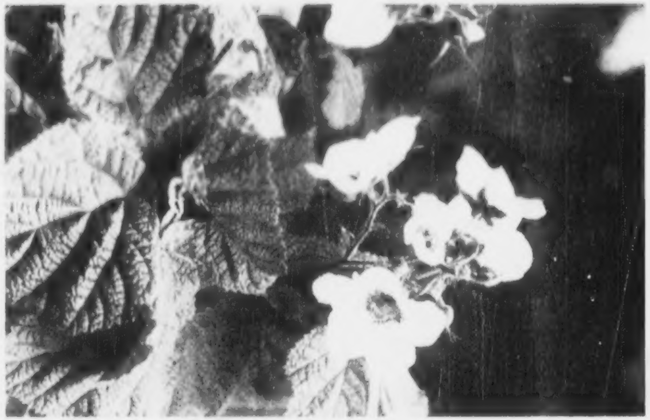


Fig. 11. Red-legged frog. Milburn Lake.

Fig. 13. Thimble berry at Summit Lake. Note tiger moth on leaf.

the surface of the water. Species represented were: *Stagnicola binneyi* (Tryon), *Stagnicola palustris nuttalliana* (Lea) *Helisoma anceps* (Menke), *Gyraulus vermicularis* (Gould), *Physella ampullacea* (Gould), *Ferrissia parallella* (Haldeman), *Valvata Lewisi helicoidea* Dall, *Pisidium variabile* Prime. No live specimens were found.

There is a fish population of Columbia River chub *Mylocheilus caurinus*, ling *Lota* lota, sucker *Catostomus* sp., and squawfish *Ptychocheilus oregonensis*. Dead specimens of the three species last named were examined. One of the ling may have weighed between five and six pounds, and one of the suckers three pounds. The chub were seen in large shoals in the shallow water. Kamloops trout are said to occur in small numbers.

There is much good nesting cover for such diving ducks as red-head, canvas-back and ruddy duck, while the island and large tracts on the lake shore are suited to the nesting requirements of lesser scaup duck and pond ducks. Nevertheless the waterfowl population, perhaps because of the slight amount of animal food, is very small. During a complete circuit of the lake by canoe on June 9, the following birds were seen or heard: loon, 2 pair and one downy young: pied-billed grebe, 2; bittern, 1; cinnamon teal, 3; ring-necked duck, 1; lesser scaup duck, 1; Barrow golden-eye, 1; American coot, 3 adults, one with 8 young; sora, 1.

Dale Lake: An expansion of the north fork of Sister Creek on the east side of the Fraser River about 12 miles southeast of, and at an altitude approximately 500 feet above, Quesnel. The north fork of Sister Creek winds through an open meadow approximately a mile long and half a mile wide. As a result of conditions which are described later it has backed up into the meadow and formed a slough, or a series of sloughs, without definite boundaries that vary in extent and depth in accordance with the height of the water level in the creek. This is Dale Lake, locally known as "China Lake" (Fig. 12). At the south end of the meadow the creek enters a narrow, wooded valley and continues in a westerly direction to empty into the Fraser River. The sloughs are largely a by-product of an early mining venture, and subsequent work by beaver. The details as told me by several persons are as follow:

About 1892 a number of Chinese placer miners built an earth dam across the narrow valley referred to, at a point some 200 yards below the meadow--the object being the storage of sufficient water to operate certain placer claims on benches above the Fraser River, several miles to the west. The ditch constructed for the passage of this water is still recognizable. How long this project was maintained is not known, but I was told it was not in operation in 1902, and the creek then as now passed underneath the dam. At that time the dam was covered with sapling aspens and black cottonwoods and the meadow was dry or nearly so. At present the dam forms so integral a part of the surroundings that its artificial origin is not readily apparent. It measures approximately 200 feet in length, 12 feet in height and eight feet in width. Some of the black cottonwoods, or their successors, described as being saplings in 1902, now approximate 20 inches in diameter. It is stated that until quite recently the meadow, and Dale Lake, continued dry or held only a little water during the spring near its southern end. Early in 1943 a pair of beaver took possession of the narrow valley below the meadow and partly plugged, or dammed, the small passage under the old dam so that the water backed up and formed a pool above it. In the spring of 1944, the passage was more thoroughly plugged so that the pool deepened and inundated the alder, willow and aspen that grew thickly in the valley. On June 19 the pool was about one acre in extent and the trees stood in water up to 18 inches in depth. They were in leaf but had not been flooded long enough to show the effects. There was one large beaver lodge about 100 feet from the north bank and another smaller one beyond, barely visible through the intervening trees. Along the sloping banks above the pond numerous aspens, some measuring eight inches in diameter, had been felled, the branches chiselled off and most of the bark eaten from the main trunks by beaver. At the south end of the meadow, just beyond the outermost shrubbery fringing its boundaries, a strip of cultivated hayland 100 yards or more in width and partly flooded, extended to the edge of the slough referred to earlier. Beyond the slough the meadow was covered with wild grasses and sedges, and near the north end could be seen a small round-stem bulrush marsh.

The bird population on and about the slough consisted of: mallard, 3 adult females, brood of 8, one-third grown, brood of 9, one-half grown; pintail, 5 males; blue-winged teal, 1 pair; ring-necked duck, 10 males; buffle-head, 2 yearling females; American coot, 1 adult with 6 young and 3 other adults; killdeer, 1; greater yellow-legs, 2; Wilson phalarope, adult with downy young; black tern, 3; red-winged blackbird, 1 pair. Very likely the population was larger than counted as in all probability other ducks, concealed in the meadow cover, escaped observation. Even so the total counted represents a large population for this region and undoubtedly the very favourable conditions created by beaver are responsible for it.

Region Between Cottonwood and Quesnel Rivers

On the east side of the Fraser River above and beyond the deciduous woodlands is a heavily forested region at a mean elevation of 3,000 feet. It is subject to greater precipitation than the more open conferous forest region at the same altitude west of the Fraser River. Probably it approximates that of Barkerville, 40 miles east and north of Quesnel, where the annual precipitation for a 10-year period was 35.5 inches. The terrain is rough and broken with small, usually deep lakes in some of the valleys between the intervening ridges. The forest cover is lodgepole pine, Engelmann spruce, Douglas fir and alpine fir Abies lasiocarpa with comparatively little undergrowth. Black twin-berry of small size is one of the commoner shrubs; blueberries and kinnikinnick are abundant. In places the forest floor is mossy and through this green carpet grow a variety of plants amongst them false box Pachystima myrsinites, false Solomon's seal Smilacina stellata, Clintonia Clintonia uniflora, oak fern Phegopteris dryopteris, and masses of bunch berry. Aspen dominates the burned-over areas and occurs in greater size along the numerous streams, together with black cottonwood, alder, western birch, willow and some black spruce. Here the undergrowth is heavy, conspicuous elements being thimble berry, cow parsnip, tall fern and Indian hellebore Veratrum viride.

In late August most of the summer population of land birds except song sparrows had left. Transient golden-crowned kinglets, ruby-crowned kinglets, winter wrens, Tennessee warblers, Audubon warblers and white-crowned sparrows were passing through. Among the resident birds recorded were goshawk, Franklin grouse, horned owl, American three-toed woodpecker, Canada jay and Hudsonian chickadee.

Four deep lakes connected by running streams and tributary to Cottonwood River are known as Beaver House, Fifteen Mile, Sixteen Mile and Edy. These and other local lakes were inspected in late August.

Fifteen Mile Lake: Approximately 3/4 mile long, 3/8 mile wide, situated close to the Quesnel-Barkerville Road, 15 miles east of Quesnel. This is a crescent-shaped lake with small sedge meadows at either end and surrounded by forest of the prevailing type. There are four inhabited beaver lodges on the shore and several beaver dams across Fifteen Mile Creek near the outlet. At the time of inspection, the sedge meadows, an old wagon road along shore and a bridge across the creek were under water. On August 23 four mallard and one Holboell grebe were seen there.

Sixteen Mile Lake: Approximately 3/4 mile long, 1/2 mile wide, situated one mile north of Fifteen Mile Lake. The shore growth is willow and alder against a coniferous forest background. In front of the deciduous growth are sedges and some hardhack *Spiraea Douglasii*. The most abundant plant in the lake is a pondweed *Potamogeton pusillus*; other species noted were water buttercup, water smartweed and yellow pond lily. Most of the latter had been eaten recently by beaver There is little invertebrate life, the only animals taken being a damselfly nymph and a water bug *Sigara solensis* (Hung). The waterfowl population appeared to be limited to one brood of mallard.

"Beaver House Lake": Approximately 1/2 mile long, 1/4 mile wide, situated about four miles south of Sixteen Mile Lake and the Quesnel-Barkerville Road. It is surrounded by deep forest with Douglas fir prominent on the surrounding ridge. The shores are hard with the usual littoral growth of willow and alder. There is a fish population of Kamloops trout, suckers, squawfish and lake shiners. Food plants are not abundant, the species commonest along the shore being the pondweed *Potamogeton gramineus*. No waterfowl were observed on August 24.

Edy Lake: 3/4 mile long, 1/2 mile wide, situated one and a half miles north of Sixteen Mile Lake with which it is connected, and draining into the Cottonwood River through Fry Creek. This lake is similar to those described above. It contains a population of beaver and the surrounding alders and willows are dead from flooding. A pair of loons were the only waterfowl seen there on August 23

Ten Mile Lake: 1 3/4 miles long, 1/2 to 1 mile wide, situated 10 miles north of Quesnel, and one mile east of the highway to Prince George. This is a deep, hard-shored lake with the usual shoreline vegetation of alder and willow. At many places are small round-stem bulrush marshes and beds of horsetail or spike rush. No waterfowl were seen from shore when this lake was visited on June 20.

Summit Lake Region

The road from Prince George to Summit Lake, a distance of 32 miles, ascends the Salmon River valley then crosses the divide separating the Pacific and Arctic drainage systems. Much of the district has been burned-over and is now in the aspen stage of reforestation. In the valley are several large farms and numerous smaller holdings, some with rich fields of alsike clover. In late June roadsides and meadows were covered with blossoming buttercups Ranunculus acris and ox-eye daisies Chrysanthemum leucanthemum.

Summit Lake, the headwaters of Crooked River, is embarkation and shipping point for a number of northern trading posts. In early summer it is headquarters for trappers engaged in shipping their winter supplies down the river in flat boats. This seemed a favourable opportunity to obtain information regarding wildlife in the northern districts, consequently I spent eight days there and in that time interviewed a number of trappers, most of whom readily answered my questions.

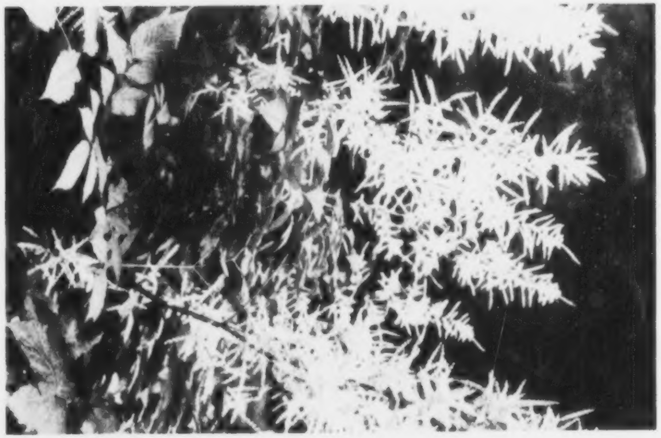
Summit Lake: 7 miles long, 1/2 to 1 1/4 miles wide, altitude 2,400 feet, is included within the boundaries of Summit Lake Park. It is surrounded by a rough, heavily forested terrain of which the highest point, Teapot Mountain, is 2,967 feet altitude. Green coniferous forest is continuous except in swampy draws; none has been burned. Engelmann spruce, many of large size, predominate; alpine fir is next and Douglas fir third in abundance. Lodgepole pine is not plentiful near the lake. In places where the land slopes somewhat steeply from the shore the lower branches of the conifers for 20 to 30 feet above the ground are dead and hung with tree moss, Usnea sp. Many spruces have a diameter of 16 inches and more, and the fewer Douglas fir are larger still. The stump of one that had been felled measured 38 inches in diameter.

The forest floor in late June was carpeted with a variety of flowering plants, amongst them twinflower Linnaeus borealis, bunchberry, mitrewort Mitella pentandra, pale corydalis Corydalis sempervirens, Indian helebore and false Solomon's seal. Ferns, cow parsnip, horsetail Equisetum sylvaticum, devil's club Fatsia horrida, skunk cabbage Lysichiton americanum, rein orchid Habenaria dilatata and ladies' tresses Spiranthes sp. are prominent items in the vegetation covering moist depressions. In open drier places grow red columbine Aquilegia formosa, self-heal Prunella vulgaris, yarrow Achillea sp., avens Geum macrophyllum, Indian paint brush Castilleja sp., fireweed Epilobium Sp., chickweed Stellaria longipes, bracken Pteris aquilina, wintergreen Pyrola chlorantha and P. secunda, and cow wheat Melampyrum lineare. One clump of juniper Juniper communis, was observed.

On the shores amongst the conifers, are small aspen and black cottonwood, western birch, willow and alder. Several small flats have a dense shrubbery of mountain ash *Pyrus occidentalis*, Rocky Mountain maple *Acer glabrum*, huckleberry *Vaccinium membranaceum*, soopolallie, black twin-berry, service berry *Amelanchier alnifolia*, dogwood *Cornus stolonifera*, waxberry, rose, highbush cranberry *Viburnum pauciflorum*, false box, red raspberry *Rubus strigosus*, swamp gooseberry *Ribes lacustre*, thimble berry (Fig 13), red elder *Sambucus racemosa*, birch-leaf spirea and goat's board *Aruncus sylvester*, (Fig 14). Where clearings have been made in the forest a dense undergrowth of fern, thimble berry, goat's beard, black twin-berry, alder and other shrubs quickly grow to a height that hides the stumps of the felled trees. There are a number of such places, the one of greatest extent being a road slashing extending for several miles northward from the south end of the lake (Fig. 15). Here goat's beard grows to a height of six and seven feet with flower spikes 18 inches in length. These brushy clearings and the small areas of deciduous woods have a bird population, chiefly warblers, greater in density than I have observed elsewhere in the forests of British Columbia. Each of the numerous populations was similar in composition, consisting usually of Tennessee warbler, magnolia warbler, Macgillivray warbler and water-thrush; some also included a pair of redstarts, Lincoln sparrow or song sparrow. Amongst the conifers along the edges of the clearings were western tanager, red-breasted nuthatch, olive-backed thrush, warbling vireo, chipping sparrow and Oregon junco.

There are a number of large, forested islands in the lake and between them and the mainland narrow channels, some with long marshy bays, extend inland. The beach along the main part of the lake and the shelving lake bottom is composed largely of boulders of rather uniform size from four to six inches in diameter. The water is clear, cold and of a brownish tinge. One of the marshy bays referred to extends eastward for about three-quarters of a mile. The water is shallow over a predominantly marl bottom; a mixed forest of conifers, western birch, alder and black cottonwood reaches the shore for the greater part of its length on both sides but here and there small fingers of land covered with shrubbery and terminating in marsh growth extend outward. The shrubbery is chiefly dwarf birch, willow, alder, black twin-berry, and on the outer margins grow hardhack, marsh cinquefoil and buckbean *Menyanthes trifoliata*. The terminal marshy tracts are composed of whitetop, tall reed grass, spike rush, and horsetail *Equisetum arvense*, *E. palustre*, *E. limosum*.

A small sluggish creek empties into the end of this bay. Its shores are hidden by masses of alder, dwarf birch, black twinberry and red-osier dogwood that in places form an arch over the channel. On its margin water arum grows thickly (Fig 16). On the alluvial deposit at its mouth was found the largest amounts of submerged flora seen anywhere on the lake. This consisted of



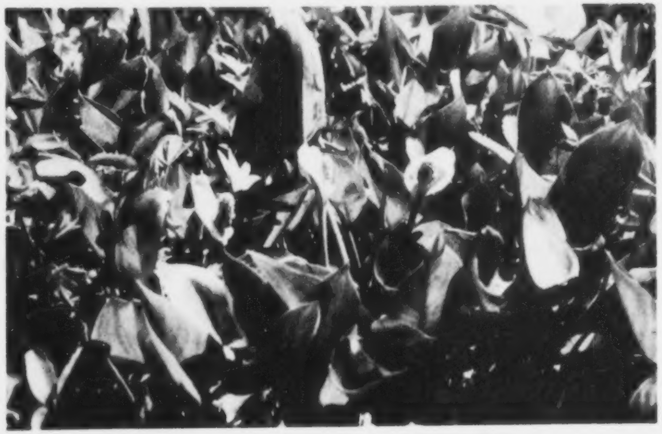
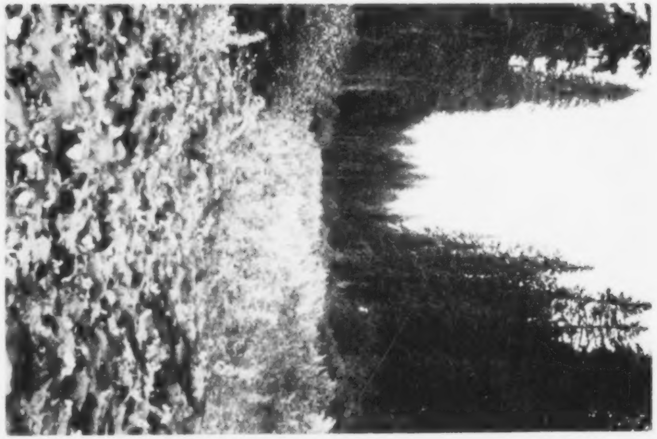


Fig. 14. Goat's beard at Summit Lake.

Fig. 16. Water arum, Summit Lake.



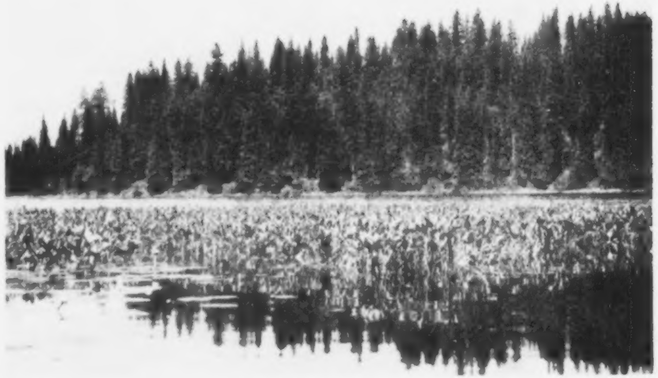


Fig. 15. Thimble berry and goat's beard in road slash, Summit Lake.

Fig. 17. Buckbean, Summit Lake.

the following plants: water buttercup, water milfoil *Myriophyllum alternifolium*, the pondweeds *Potamogeton natans*, *P. richardsonii*, *P. gramineus*, *P. robbinsii*, and *P. perfoliatus*, arrowhead *Sagittaria cuneata*, and hornwort. Seeds of the latter, probably representing the previous year's crop, were dredged from the bottom. Elsewhere were found patches of charophytes and numerous beds of buckbean, the latter growing in many places along shore and in isolated beds. One such bed measured approximately 30 feet by 12 feet (Fig. 17). Specimens of the small white water lily *Nymphaea tetragona* were found here (Fig. 18).

Animal food was not abundant and constant dredging produced only a few molluscs, amphipods *Hyalella azteca*, caddis larvae, dragonfly nymphs, bloodworms and the beetles *Deronectes striatellus* LeC. and *Hydroporus sericeus* LeC. Molluscs identified are: *Stagnicola palustris nuttalliana* (Lea), *Helisoma subcrenatum* (Carpenter), *Physella ampullaceae* (Gould), *Pisidium variabile* Prime and *Pisidium adamsi* Prime. A large mussel *Anodonta kennerlyi* Lea is fairly plentiful.

The lake is said to have a fish population of Kamloops trout, lake char *Cristivomer namaycush*, suckers, squawfish, Columbia River chub and lake shiners. Examples of the three species last named were examined.

No ducks or grebe were observed; it seems probable that the marshy bays provide feeing places for waterfowl on migration. The lake and its surroundings are sub-marginal nesting ground.

Muskeg Lake: A short distance south of Summit Lake and close to the Summit Lake-Prince George Road, is a five acre pond partially covered with pond lily leaves. Surrounding it on three sides is open muskeg containing a varied bog and alpine flora that includes a dwarf willow *Salix pediculates* var. *hypoglauca*, cranberry *Oxycoccus quadripetalus*, Labrador tea *Ledum groenlandicum*, wild rosemary, buckbean, false asphodel *Tofieldia glutinosa*, dwarf raspberry *Rubus acaulis* and long-leaved sundew *Drosera anglica*. Between the open muskeg and the margin of the forest are isolated clumps of dwarf birch.

No ducks were on the lake, the only water birds seen on each of several times the muskeg was visited being two adult greater yellowlegs. The land bird population was small and limited to song sparrows and Lincoln sparrows.

Nukko Lake Region

(Northwest of Prince George)

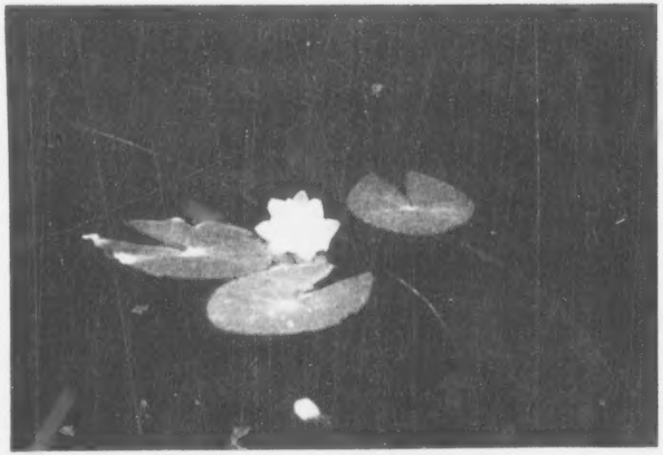
The forest in this region is drier with less undergrowth than are the forests at Summit Lake and along the Fraser River Valley. From the west side of Chief Lake a burned area extends westward for some miles. Elsewhere the higher land has a fairly open forest type of Engelmann spruce, alpine fir and lodgepole pine; grasses and forbs rather than shrubbery are associated with it. The same type of forest extends close to the shore of the lakes but on this moister soil are some large Douglas fir and a mixture of deciduous trees in which western birch, black cottonwood and aspen are prominent. Logging is being carried on extensively and numerous mills are in operation. The region also includes large tracts of muskeg.

Amongst the land birds observed about the clearings, the burns and in the forest were sparrow hawk, red-shafted flicker, hairy woodpecker, oliver-sided flycatcher, tree swallow, cliff swallow, American robin, olive-backed thrush, Tennessee warbler, magnolia warbler, Audubon warbler, water thrush, Brewer blackbird, cowbird, western tanager, purple finch, chipping sparrow and Oregon junco.

Nukko Lake: 2 3/4 miles long, north and south, 1/2 to 1 mile wide, approximately 16 miles northwest of Prince George. This is a fairly deep lake with sand and gravel beaches except in the numerous marshy bays. The adjacent forest is that typical of the region with willow and alder thickets dominating the shore line. There are several small farms fronting on the lake and some lake shore acreage occupied in summer by residents of Prince George.

About half a mile from the north end of the lake two peninsulas, one on the east, the other on the west, divide the waters into two sections that are connected by a channel some 50 yards wide. The channel and that part of the lake--its greater part--lying to the south are not visible to one standing at an opposite point on the north shore. This configuration is not indicated on the map used while studying the region, viz.; Map 3A, Pre-emption series, British Columbia Land Department.

The peninsula on the east side is narrow and extends out like a long finger from a broad timbered base. Towards the end willows form thick cover while the terminating 200 yards is a dry sedge flat (*Carex lasiocarpa*, *C. rostrata*) with round-stem bulrush marsh (*Scirpus validus*) on either side. Directly opposite the end of this spit across the narrow channel is the apex of the second,



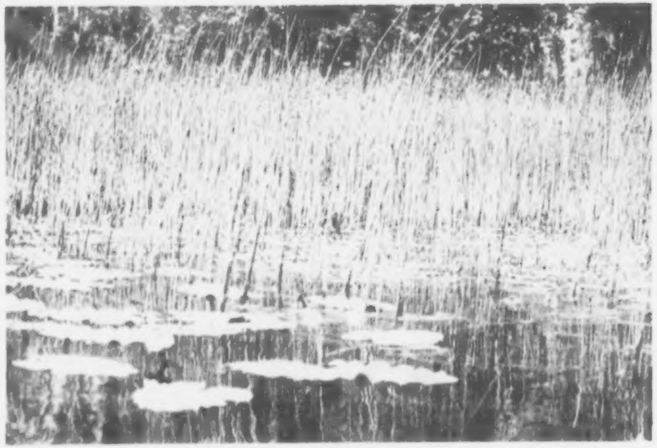
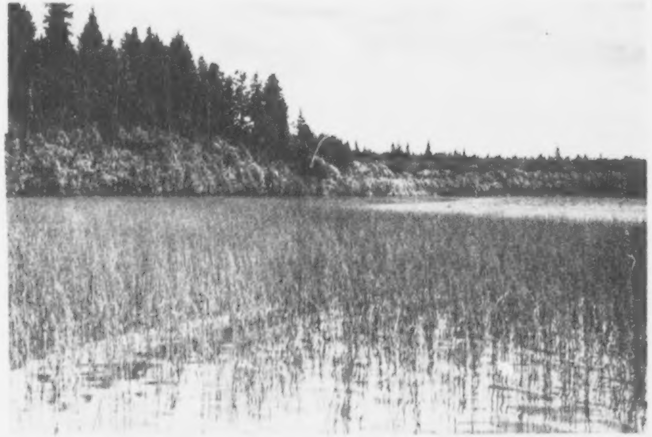


Fig. 18. White water lily.
Nymphaea tetragona--
Summit Lake.

Fig. 20. Water buttercup amongst round-stem bulrush and yellow pond lily.



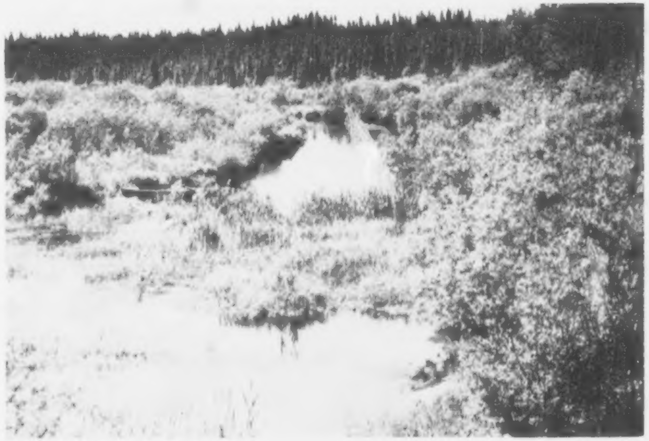


Fig. 19. Horsetail marsh, Nukko Lake.

Fig. 21. Beaver dam on Nukko Creek, below this the creek bed is steep and rocky.

broader peninsula and this is heavily wooded like most other parts of the shore; along this side of the intervening channel are marshes of horsetail and cattail.

Out from the hard shores on the northern section of the lake are several small horsetail marshes (Fig. 19). In the northwest corner is a shallow bay some 75 acres in extent and the outlet of the lake--a narrow creek connecting Nukko Lake with Chief Lake about two miles to the north. Here the water is shallow, the bottom deep marl in places, and clay covered with dessicated vegetation in others. The shores are chiefly sedge and horsetail marsh (Equisetum limosum) but marsh cinque-foil dominates some areas farther inshore. This plant grows larger in these northern marshes than it does in southern British Columbia and becomes an important cover plant. In one place is a bed of round-stem bulrush about 30 feet in circumference, and in another a small clump of cattail. There is an abundant submerged flora including extensive beds of pondweed Potamogeton Robbinsii, P. natans, P. perfoliatus, P. praelongus and patches of arrowhead Sagittaria cuneata.

Molluscs, including mussels, clams, and snails are very abundant but the amount of insect larvae is small. In the shallows were observed large shoals of lake shiners and Columbia River chub. Other fishes said to be in the lake are Kamloops trout, suckers, squawfish, ling and whitefish.

The shore line of the southern and main portion of the lake is irregular by reason of the several long peninsulas and extensive bays. Marshes of horsetail and round-steam bulrush, in clear stands and of varying widths, is continuous along the shore. No information regarding precise depths is available but the lake appears to be generally deep with shallows restricted to shore areas and the upper portions of the bays. These have hard bottoms and along the outer margins of the prevailing horsetail and round-stem bulrush such plants as water smartweed and water milfoil grow profusely. Water buttercup Ranunculus trichophyllus is abundant in shallow, open water and amongst open stands of bulrush (Fig. 20). Some inshore areas are dominated by arrowhead and in places yellow pond lily is plentiful. In deeper water are chara meadows and forests of pondweed Potamogaton amplifolius, with stems 15 feet and more in length.

Invertebrates other than molluscs were not found to be plentiful anywhere in the lake. Amphipods were notably scarce and Hyelella azteca was the only species found. Only four adult damselflies were seen; no nymphs of this group, and only one waterbug Sigara solensis (Hung.), were taken by dredging. The molluscs identified are: Lymnaea stagnalis jugularis Say, Stagnicola near preblei (Dall), Helisoma subcrenatum (Carpenter), Physella ampullacea (Gould), Sphaerium sulcatum (Lamarck) and Anodonta kennerlyi Lea.

Nukko Lake contains plant food and animal food in the form of molluscs sufficient for a large waterfowl population. There is also much good nesting cover, both marsh and dry types. The willow cover and sedge meadow, on the terminal portion of the peninsula referred to earlier, is adapted to the nesting requirements of pond ducks and lesser scaup duck, while the bulrush marshes should fulfill the needs of coots and some diving ducks. Nevertheless waterfowl were scarce. The population, as observed during thorough examinations on several days, consisted of the following: loon, 2 pairs; Holboell grebe, 9 pairs; mallard, female and brood; ring-necked duck, 2 females and broods.

Swamp Lake: 1 1/2 miles long, 1 1/4 miles wide, about one mile east of Nukko Lake and draining into Chief Lake, some three miles to the northwest, through a narrow, sluggish creek overhung with shrubbery. Swamp Lake, nearly circular in shape, is surrounded by black spruce in a belt averaging 100 yards in width. The floor of this forest is deep in moss. Farther back is muskeg on which dwarf birch and small black spruce is the tallest growth. Hardhack, buckbean, Labrador tea, dwarf willow, cottongrass Eriophorum chamissonis, wild rosemary, cranberry, rein orchid, false asphodel, ladies' tresses, and lousewort Pedicularis parviflora grow amongst the sphagnum. A narrow strip of shoreline between the edge of the spruce and the water is boggy with some growth of shrubbery and sedges. In the immediate shallows grow yellow pond lily, and a small amount of pondweed Potamogeton natans shows above the muddy water.

The only water birds seen here on July 5 were four downy young ring-necked ducks, one female buffle-head and a small colony of Bonaparte gulls that probably were nesting. These observations were made on a cold, rainy day and from the shore only. While further inspections under more favourable conditions might have revealed a larger population, nevertheless Swamp Lake cannot be considered of much value as a nesting ground for waterfowl.

There were few small birds in the vicinity; a song sparrow was heard singing and Hudsonian chickadees were seen.

Forest ponds: Typical of these is a small pond in the lodgepole pine and aspen forest between Nukko Lake and Swamp Lake. It is fringed with willows and contains a large amount of submerged vegetation. Apparently no ducks were using it, the only water birds observed being a pair of greater yellowlegs. Ponds of this type in the Cariboo Parklands usually support three or four pairs of pond ducks.

Rubai Lake: 1/2 mile long, 1/4 mile wide, between Nukko Lake and Chief Lake and draining into the latter. This has similar shoreline and the same aquatic vegetation as Nukko Lake. No waterfowl were observed there.

Nukko Creek and Chief Lake: The latter 3 1/2 miles long, 3/4 to 2 miles wide; 1 1/2 miles north of Nukko Lake. A large section of forest on the west side of the lake was burned about 10 years ago and is now grown up with aspen, otherwise the surroundings are similar to those at Nukko Lake. At one place amongst the usual riparian growth a small clump of wild cherry was observed. Except in marshy bays the shores are chiefly sand and gravel. Along sections of the east shore coniferous forest reaches the lake margin. The water is muddy and is said not to exceed 16 feet in greatest depth. A growth of horsetail widening to 50 yards or more in numerous places is almost continuous along the shore and in these open marshes the pondweeds *Potamogeton richardsonii*, *P. zosteriformis*, *P. alpinus* var. *tenuiflora*, *P. gramineus*, *P. nodosus*, *P. perfoliatus*, and water smartweed are plentiful. Near the centre of the lake are extensive beds of *Potamogeton amplifolius*. On some sections of the east shore the prevailing horsetail is replaced by stretches of spike rush *Eleocharis palustris*, and there is one narrow bed of round-steam bulrush *Scirpus acutus* about 300 yards in length. Two streams passing through thick willow and alder bottoms enter the lake, one at the south draining Rubai Lake, the other on the east side draining Swamp Lake. At the mouths of these streams, and for some distance on either side, are beds of yellow pond lily and much submerged vegetation including pondweeds of several species.

Chief Lake drains into Salmon River, some four miles to the north, through Nukko Creek and travel down this stream by canoe is possible for about one mile where a beaver dam prevents further progress (Fig. 21). Below this the stream bed is steep and rocky. For a mile or so below the outlet (Fig. 22) Nukko Creek is contained within a half-mile wide valley filled with sedge-covered bog so that its channel is not everywhere clearly defined. Sections of the channel are narow and deep; others widen to pond size and here yellow pond lily covers some of the deeper portions, while Robbin's pondweed, bladderwort and water buttercup form thick beds of vegetation in the shallows; greater duckweed is abundant. Sedges of various species are the prevailing type of vegetation on the boggy shore; there are patches of cattail, and where the shore is broken down and submerged, are stretches of horsetail, buckbean and water arum (Fig. 23). Amongst the sedges along the stream grow numerous plants such as bur reed *Sparganium multipedunculatum*, marsh skull cap *Scutellaria epilobifolia*, loosestrife *Lysimachia thyrsiflora*, cress *Roripa palustris* var. *glabrata*, marsh cinquefoil and dock *Rumex maritimus*.

Invertebrate life is not abundant judged by the material collected that consisted of a few amphipods, a beetle *Haliplus immaculicollis* Harris, one damselfly and two mayfly nymphs, and seven nymphs, and two adults of a waterbug *Sigara mullettensis*. The only molluscs taken were several young of *Helisoma* and *Physella*. The fish population is said to include Kamloops trout, lake char, Eastern whitefish *Coregonus clupeiformis*, Columbia River chub, coarse-scaled sucker *Catostomus macrocheilus*, squawfish and lake shiner. Specimens of the four last named were examined.

A census of the waterbird population on July 7 is as follows: loon, 1 pair; Holboell grebe, 1 pair; American bittern, 1; mallard, 2 females with broods; buffle-head, 2 yearling females; solitary sandpiper, 1; spotted sandpiper, 1; semipalmated sandpiper, 6; Wilson phalarope, 3; black tern, 20 to 30 pairs.

According to local report Chief Lake is frequented by large numbers of ducks during migration; it is little used as a nesting place.

Brule Lake: Approximately 90 acres, about four miles southwest of Chief Lake in the burned-over area referred to earlier. The shores are boggy, sedge-covered on the inner, and with horsetail marsh on the outer, margin. There is considerable growth of water hemlock *Cicuta Douglasii*, sedge *Carex stipata*, dock *Rumex Brittanica* and one clump of cattail, the latter introduced, along the shore. The water surface is more or less covered with yellow pond lily; there are quantities of pondweeds, and duckweed is abundant amongst the horsetail. No water birds were observed on this lake.

Murch Lake: 1 1/4 miles long, 1/4 to 1/2 mile wide; about one-half mile west of Brule Lake. The fire which swept this district was checked before the shoreline timber was destroyed, so that the large Douglas fir and Engelmann spruce along the lake are intact. The shores are part gravel, part boggy with horsetail marshes. The submerged vegetation is similar to that of Brule Lake; the fish life consists of squawfish, lake shiner, suckers and Columbia River chub. The only water birds observed were a pair of loons and one pair of Holboell grebe.

Tsula Lake: A short distance east of Brule Lake is similar in character. This and other lakes in the vicinity are of slight importance as waterfowl nesting grounds.

Ootsa Lake Region

The region between Francois Lake and Ootsa Lake, viewed from the forestry lookout on the summit, altitude 3,960 feet and eight miles north of Ootsa Lake, appears as a series of low hills and intervening basins, many of the latter containing small lakes. It is forested with conifers, chiefly lodgepole pine, Engelmann spruce and alpine fir, much of it destroyed by fire towards the Ootsa Lake side. To the north are extensive sections of prairie, some under cultivation. The small lakes on the summit are all much of the same type, viz.; bordered by alders and willow with some sedge marsh, pond lilies and small amounts of submerged vegetation. They contain molluscs and aquatic insect larvae. None appears to be attractive to waterfowl.

Along Ootsa Lake near Ootsa Lake settlement are open slopes and flats, some under cultivation. Westward, to Wistaria and beyond, the country is rolling with some of the lowlands covered by dwarf birch and willow and elsewhere a forest type predominantly aspen. In August the small streams and sloughs were low, some completely dry. One slough, approximately 350 yards long and 50 yards wide, situated about three miles northwest of Wistaria is typical of many others. The forest surrounding it is chiefly aspen on the north side and lodgepole pine and Engelmann spruce on the south side. The shore is surrounded by sedges and the chief growth in the water is yellow pond lily, the leaves upright and standing several inches above the surface. A flock of eight mallards was flushed from this lake.

Farther to the northwest on Shelford's farm two artificial beaver ponds contained the following waterfowl, viz.: pied-billed grebe, 1; mallard, 1 female with brood of 5; pintail, 1 female; green-winged teal, brood of 8; buffle-head, brood of 6. The excreta of ducks deposited on the shore showed that blueberries had been eaten. These berries Vaccinium caespitosum were plentiful close to the shores of the beaver ponds.

At the west end of the lake and along the Tahtsa River are wide hay meadows that are reported to be under water in early summer. Canada geese are said to nest there but because of the unstable water level it seems unlikely that many ducks do so. Reports indicate, however, that it is a gathering place for both geese and ducks on migration, and it is known to be a resort of goose hunters.

East of Ootsa Lake post-office a settlers' road, after climbing about 500 feet through open country, continues through heavily-forested bottoms and along open side hills. The region is all hilly and rough and some has been burned. There are occupied bush farms in this section and others that have been abandoned.

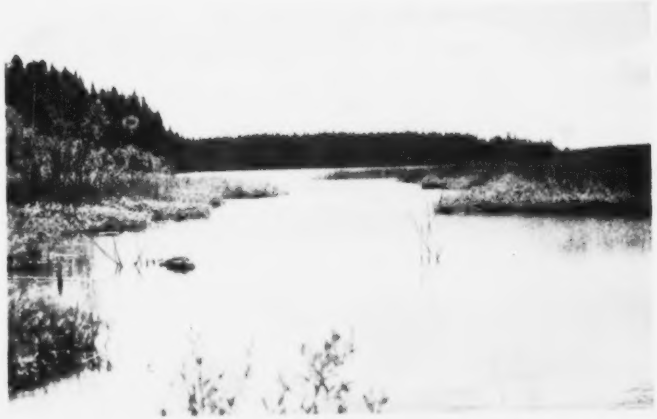
Numerous lakes in this section are of several different types. One of two acres or so, is situated in a 10 acre meadow of sedge and this growth extends to the boggy shores. Yellow pond lily, the leaves erect and six inches or so above the water, encircle the lake. Here were two horned grebes and a female lesser scaup duck with 12 large young. Another lake of five acres, approximately, in the conifer forest, is similar but lacks the broad encirclement of sedge meadow. On this were a brood of six baldpate and two female buffle-head. Spud Lake, 30 acres or more, has all but a small portion of the surface covered with yellow pond lily. One loon was the only water bird observed there. Another lake half a mile or more in length has an open flat of dwarf birch and willows on one side, and some sedge marsh on the other.

Francois Lake Region

Francois Lake is 65 miles long; the portion of the adjoining region examined was that adjacent to and west of Francois Lake settlement, situated on the north side of the lake about midway and approximately 12 miles south of Burns Lake. The land on the north side is rolling with some areas of grassland, a few muskegs in which tall Labrador tea is dominant, numerous small lakes, and a forest cover predominantly aspen. The sections of coniferous forest are mainly lodgepole pine and Engelmann spruce. A relatively light precipitation is indicated by the slight amount of undergrowth, mainly rose, birch-leaf, spirea, soopolallie, forbs and grasses. Through these dry uplands is evidence in the form of dry creeks, now holding water only in spring, and partly eroded grasslands that a more favourable primitive environment has not been maintained. Possibly the reported local extermination of beaver was a factor in the present deterioration. A much more luxuriant vegetation consisting mainly of cow parsnip and of such shrubs as raspberry, black twinberry, black currant Ribes Hudsonianum, and swamp gooseberry, prevails along the thick willow bottoms and near the margins of sloughs.

From the settlement a road follows the lake to its western end and then turns southeast to Ootsa Lake (Fig. 24). Black cottonwood and aspen is the chief tree growth along the shore that is notable otherwise for its many beaches of fine shingle. Snodgrass Creek, that drains several small lakes, reaches the lake across a narrow, boulder beach about three miles west of the settlement. A few miles farther west is a picturesque escarpment, its steeply sloping base grown up with shrubbery and small aspens (Fig. 25).

Slopes above the south shore of the lake are dark with conifers. It should be observed that an aspen association on slopes with a



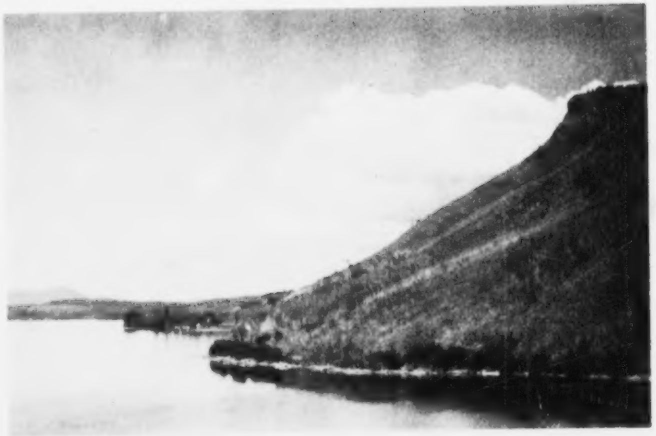
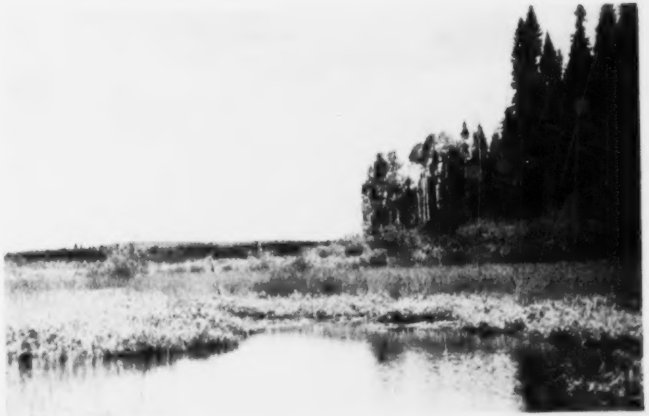


Fig. 22. Nukko Creek, outlet of Chief Lake.

Fig. 24. Approaching west end of Francois Lake.



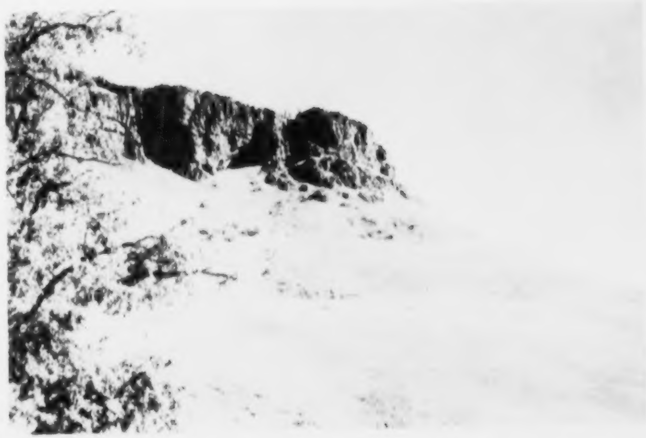


Fig. 23. Buckbean and water arum, Nukko Creek.

Fig. 25. Escarpment on north side of Francois Lake.

southern exposure and a conifer association on slopes with a northern exposure are characteristic of the lands adjoining lakes, even the small ones, in much of central British Columbia.

Waterfowl were more plentiful than in any of the regions hitherto described, and several lakes held relatively large populations. On August 4 an early autumn migration of sparrows was in progress, the species and estimated numbers observed being: chipping sparrow, 50; vesper sparrow, 10; Oregon junco, 10; white-crowned sparrow, 8. On August 8 a migration of robins took place and during the two days following, ruby-crowned kinglet, Audubon warbler, Macgillivray warbler, Wilson warbler and redstart became conspicuous.

"*Keefe Lake*": Approximately 12 acres in lots 938 and 939, (Preemptor series Map 3B, British Columbia Department of Lands). This small lake is margined by a 50-foot strip of sedge bog enclosed within a dense willow thicket in surroundings of haylands and aspen woods (Fig. 26). Along shore are beds of yellow pond lily and elsewhere an abundant growth of hornwort, water buttercup *Ranunculus trichophyllus*, and the pondweeds *Potamogeton richardsonii*, *P. pusillus* and *P. friesii*. During the times I visited the lake the water was crowded with ivy-leafed duckweed *Lemna trisulca* and quantities of greater duckweed floated on the surface. Amphipods *Gammarus limnaeus* were exceedingly abundant; dragonfly nymphs, but no damselflies either adult or nymphs, were taken. *Helisoma subcrenatum* (Carpenter) and *Physella ampullacea* (Gould) were the only molluscs collected.

The waterfowl population on August 4 and August 6 consisted of: mallard, 2 broods; baldpate, female with brood of 4; lesser scaup duck, female with brood of 4, and 1 female without brood; Barrow golden-eye, female with brood of 6; buffle-head, 1 female; white-winged scoter, female with 1 downy young. This population had been subjected to loss of young through predation and the loss continued during the time the lake was under observation.

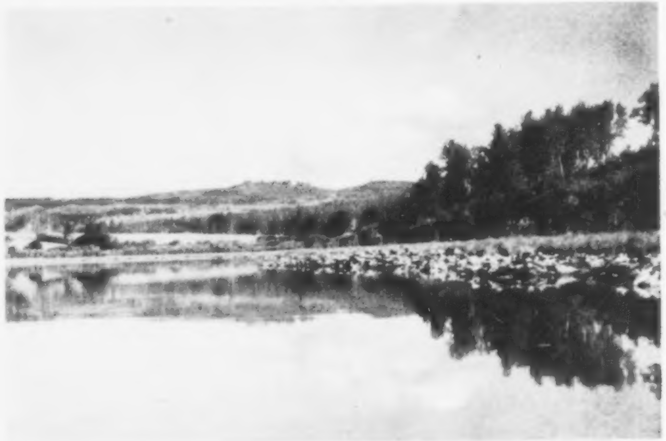
"*Stanyer Lake*": About 8 acres in lot 943, (Pre-emptor Series, Map 38, British Columbia Department of Lands). Similar in character and in plant and animal food to Keefe Lake with additional cover in the shore marsh provided by an admixture of cattails. The amphipod *Gammarus limneus*, a mollusc *Gyraulus vermicularis* and a waterbug *Notonecta kirbyi* Hung. were collected here. Ivy-leafed duckweed was very abundant and lay six inches deep on parts of the lake bottom. The waterfowl population on August 7 consisted of horned grebe, 2 adults and 6 young; mallard, 8; baldpate, female and 6 young; pintail, 1; green-winged teal, female and 6 young; ring-necked duck, female and 7 young, lesser scaup duck, 3 females and 31 young; Barrow golden-eye, 2 young.

"Shafer Lake": 1 mile long, 1/8 to 3/8 mile wide, north of Lot 941, west of Lot 5339, (Pre-emptor series, May 3B, British Columbia Department of Lands). The shores are of hard clay and small boulders interspersed by areas of soft mud or bog. Alders and willows grow close to the water's edge in front of the aspens that dominate the surrounding woodlands. The maximum depth is reported not to exceed 40 feet; along the shore for 50 to 100 feet out from the beach it averaged 18 inches. Two small bays at the north end contain sedge marshes and this growth, with bur-reed and tall grasses including manna grass and bent grass *Agrostis stolonifera*, is less abundantly distributed along other parts of the shore. A narrow section comprising the south end of the lake 250 yards or less wide is shallow with a muddy bottom. All this part is filled with a luxuriant growth of arrowhead, water buttercup, hornwort, water milfoil *Myriophyllum exalbescens* and various pondweeds including *Potamogeton Friesii*, *P. praelongus* and *P. zosteriformis*. Through this growth penetrate the stout stems of yellow pond lily and its leaves pattern the surface. In places the vegetation was intertwined and obscured by filamentous algae, in others ivy-leafed duckweed filled the spaces not otherwise occupied, and greater duckweed in large amounts floated upon the surface. Amphipods, *Gammarus limnaeus* and *Hyalella azteca*, were abundant in this mixed vegetation, so also were leeches, odonata nymphs, chironomid larvae including bloodworms, a water bug *Sigara decoratella* (Hung.) a whirligig beetle *Gyrinus wallisi* Fall, and the following molluscs: *Lymnea stagnalis jugularis*, Say, *Helisoma subcrenatum* (Carpenter) and *Physella ampullacea* (Gould).

This lake is connected by a shallow creek, that dries out in summer, with Snodgrass Lake two miles to the southwest and through Snodgrass Lake with Francois Lake. It has a fish population of which the only species observed were suckers and lake shiners.

Shafer Lake proved to be the best 'duck lake' studied during the entire summer. It was a concentration place for post-breeding mallard, lesser scaup duck and buffle-head as well as a nesting-place for these species. A census made August 7 is given below in detail.

Loon--1
Holboell grebe--1 pair
Mallard--50± including eclipse males, flying broods and one
  brood of 6 about three-quarters grown.
Baldpate--a band of 70 consisting of well-grown young and a
  few adults, 4 females and 10 young, female and
  brood of 6. Total 91
Green-winged teal--2 adults.
Lesser scaup duck--35± eclipse males, 5 yearling or non-
  breeding females, 2 females with 16 young.
  Total--58.
Barrow golden-eye--10 large young.



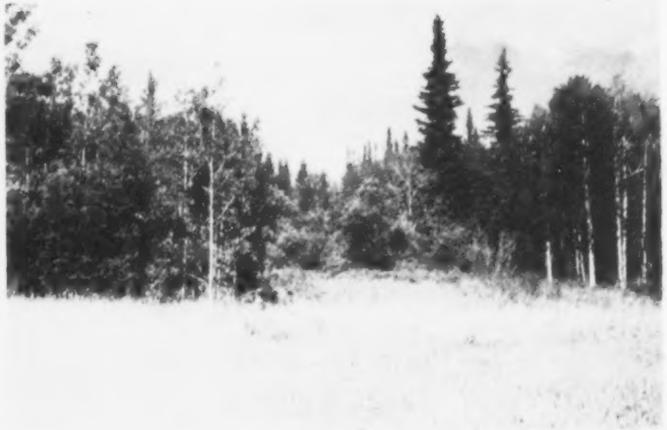
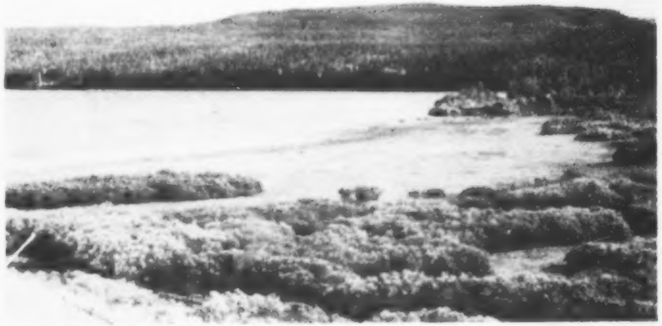


Fig. 26. Keefe Lake.

Fig. 28. Aspen spruce and grassland, north side of Bulkley Lake.



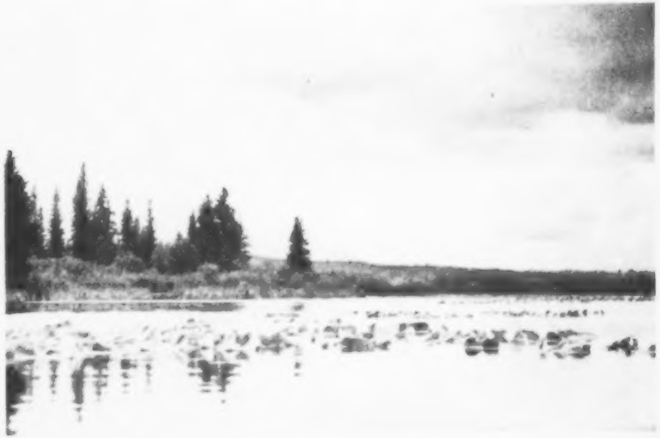


Fig. 27. Coniferous forest south side of Bulkley Lake; willow thickets and sedge marsh along west shore.

Fig. 29. Seymour Lake.

Buffle-head--band of 30± including some full-grown young.
Lesser yellowlegs--7
Semipalmated sandpiper--1
Bonaparte gull--2 adults, 7 young.

"Sanctuary Lake": Approximately the same dimensions as Shafer Lake and connected with it by a small stream about a quarter mile in length that dries out in summer. It is of quite different character with steep shores that lack cover, deep water and little submerged vegetation. No waterfowl were seen from shore and the lake was not studied in detail.

"Snodgrass Lake": 1/2 mile long, 1/8 mile wide, connected by a narrow stream with Shafer Lake and draining to Francois Lake through a stream approximately 300 yards long and 15 yards wide at its widest point. The lake was reached by this route on August 8. The shores of the stream and the lake are boggy with the usual sedge marsh between the water's edge and the surrounding willows and alders. The bottom of the stream for a short distance above its mouth on Francois Lake has a hard gravel bottom on which grow masses of water starwort Callitriche autumnalis, various pondweeds and thick beds of hornwort. Elsewhere (on August 8) the surface was covered with lily pads and the water below filled with a dense vegetation composed of the same species of plants found in Shafer Lake. This condition pertained also to a wide area about the outlet of the stream, to a bay at the north end of the lake and to a belt 40 to 75 yards wide around the remainder of the lakeshore. Elsewhere the lake is deep with no surface foliation. Invertebrate life in the waters appeared to be identical with that of Shafer Lake.

The only waterfowl observed were a female mallard accompanied by six nearly full-grown young. With the food conditions pertaining to both lakes identical, or at least closely similar, it is difficult to understand why one should be well populated and the other relatively uninhabited.

Other Lakes. Adjacent to the road between Burns Lake and Francois Lake are a series of small lakes of from five to twenty acres situated in willow bottoms and surrounded by boggy sedge marshes. None was studied in detail but it was observed that several contained a small number of ring-necked ducks or lesser scaup ducks.

Tchesinkut Lake: 10 1/2 miles long, 1 1/2 miles wide, 5 miles north of Francois Lake, is one of the deep lakes with sand and gravel beaches characteristic of the region. Several loons and Holboell grebe were observed from shore.

Burns Lake: 13 miles long, 1 1/4 miles wide, and *Decker Lake*, 7 1/2 miles long, 1/2 to 1 mile wide, both expansions of the Endako River, are deep lakes with heavily forested slopes rising from them. Marsh areas, chiefly sedges, characterize the margins of shallow bays and willow swamps are adjacent to them. *Rose Lake*, 1/2 mile long, 1/4 mile wide, headwaters of the Endako River, is similar. None of these was examined in detail. Mallard are reported to nest in small numbers and one brood of this duck was noted on Burns Lake.

Bulkley Lake and Region

Bulkley Lake: 2 3/4 miles long, 3/4 mile wide, headwaters of the Bulkley River, is situated close to the divide that in this part of the Province separates the drainage of the Fraser River from that of the Skeena River. A coniferous forest is continuous on the slopes to the south (Fig. 27); on the north the forest is chiefly aspen with glades and slopes of grassland (Fig. 28). The river valley is flat and for the most part covered with deep, rich soil, the exceptions being sections close to the river and to Maxan Creek that have become overlaid with sand, boulders and gravel--the detritus of floods. Here tall, black cottonwoods are the chief tree growth. Cultivated hay lands on the Clarke Ranch reach to within a quarter-mile of the lake where a broad band of willows and other deciduous shrubs intervenes (Fig. 27). Between the shrubbery and the lake shore is a section on which native grasses including *Alopecurus aequalis* grow to a height of five feet and more; on moister ground close to the water these give way to sedges, *Carex athrostachya*, *C. lenticularis*, *C. macloviana*, var. *pachystachya* and others, and finally to horsetail that forms a strip of marsh along all the west shore.

The outlet of the lake, the Bulkley River, is at its northwest corner. For a distance of 10 miles or so downstream the river varies in width from 20 to 60 feet in a series of shallow riffles, deep quiet reaches and log-jam pools. The shores are overhung with deciduous trees and shrubbery. At the outlet the banks are lined with tall river grass, sedges and bur-reed. Yellow pond lily grows along both sides in parallel lines that converge in the open water beyond and extend outward to cover several acres of the lake surface. Amongst the pond lilies is an abundance of pondweeds and other aquatic vegetation. Maxan Creek follows the base of a timbered ridge that rises sharply from the Clarke meadow, then, turning slightly, passes through thick willow woods and finally reaches the lake near its southeast corner about a mile west of the Bulkley River. For the last 20 yards or so it is confined within a narrow channel that cuts across a gravel beach.

The little beach extends laterally to meet the sedge and horsetail marsh on either side of the creek mouth. Maxan Creek runs cleanly over a gravelly bed, its average width of 10 feet expanded at intervals into wider pools. It has numerous backwaters that in late summer dry out except for isolated pools.

Salmon ascend the Bulkley River to Bulkley Lake and beyond to Maxan Lake, but none had arrived at the time of my visit.

Few ducks nest in or frequent the region. Two mallard were flushed a number of times from the marshes, from Maxan Creek and from a backwater pool of the Bulkley River. In the latter place a green-winged teal, that acted as though she had a brood, was observed, and four eclipse males of this species visited the beach on one occasion. These and a brood of Barrow golden-eye that lived in the river were the only ducks seen. The west end of the lake is reported to be an important resting place for transient waterfowl in spring. Swans and geese are mentioned as being plentiful, the latter and large flocks of sandhill cranes are said to feed on the fields of the Clarke Ranch.

A small number of transient waders visited the beach at the outlet of Maxan Creek, the species being semipalmated plover, killdeer, least sandpiper, semipalmated sandpiper and lesser yellowlegs.

Small land birds were abundant. Hairy woodpecker, downy woodpecker, black-capped chickadee, Audubon warbler and Oregon junco represented the species most frequently seen in the aspen woods while in the meadow thickets those present in the largest numbers were: alder flycatcher, ruby crowned kinglet, redstart, yellow throat, Macgillivray warbler, olive-backed thrush, pine siskin, chipping sparrow, purple finch, Lincoln sparrow and song sparrow. Brewer blackbirds in flocks, and American robins, pursued grasshoppers in the fields. A large migration of cliff swallows and barn swallows, accompanied by a few bank swallows, was in progress and these lined the telegraph wires.

Bulkley Valley Region

The valley of the Bulkley River northwest of Bulkley Lake broadens to wide flats in which willow swamps and meadows are prominent. Some of the side hills above are cultivated, others grassland and at many places aspen forest marches far up the mountain slope to merge with, and finally to be succeeded by, coniferous forest. To the west are the Bulkley "Telkwa" mountains and to the east, the Babine Range.

As one passes through this valley a more abundant roadside bird life becomes apparent. Sparrow hawks, mountain bluebirds, Brewer blackbirds, chipping sparrow, and vesper sparrows become common; red-shafted flickers and crows are seen more often. There are no meadowlarks. No red-tailed hawks were seen although this type of country suits their requirements, and it might be mentioned that no buteos were observed anywhere in central British Columbia.

The portion of the valley adjacent to Smithers is very attractive scenically with its numerous lakes, the broad river, the rolling foothills and, dominating the picture, the massive peaks, the glaciers and the snowfields of the Hudson Bay Mountain group.

Toboggan Lake: 1/3 mile long, 1/7 mile wide, about eight miles northwest of Smithers and near the base of Hudson Bay Mountain, is an expansion of Toboggan Creek, a stream that has its origin amongst the glaciers on that mountain. The lake is surrounded by willow, alder and dogwood and in front is a strip of horsetail, rushes, including *Juncus mertensianus*, sedges and grasses. At either end of the lake, along the mouth and the outlet of the stream, are marshes of the same kind. On July 13 the water was muddy and cold and a strong flow came down three channels, the main one through an alder and willow bottom, the others through the marsh referred to. Half a mile upstream is a beaver pond approximately 75 yards long and 20 yards wide. The submerged vegetation observed was restricted to small plants of water buttercup and bladderwort. The only invertebrates found were amphipods and blood worms, neither being plentiful.

Four adult Baird sandpiper, and one female ring-necked duck that flew over the lake, were the only water birds observed; the shed feathers of mallards were noted on top of a muskrat house.

Seymour Lake: 1 mile long, 1/4 to 1/2 mile wide, about one and a half miles south of Smithers (Fig. 29). The surrounding forest has been logged or burned off and replaced largely by deciduous growth. The shores are of sand, gravel and boulders with the usual thickets of alder and willow at high water mark. The emergent shoreline vegetation is chiefly horsetail, sedges, manna grass and spike rush; these form relatively wide marshes in several places. Buckbean is plentiful and in the shallows close to shore is a continuous bed of arrowhead *Sagittaria cuneata*--in blossom on July 13. Mixed with it are bur-reed *Sparganium multipedunculatum* and a large amount of *Potamogeton natans*, *P. gramineus* and *P. zosteriformis*. There is said to be a fish population of Kamloops trout and suckers; the only fishes seen were bullheads *Cottus asper*, the young of which were captured amongst floating vegetation. Invertebrates collected were a clam *Sphaerium sulcatum* (Lamarck), a mussel *Anodonta kennerlyi* Lea, the snails, *Lymnaea stagnalis jugularis* Say, *Stagnicola* near *preblei* (Dall), *Helisoma anceps* Menke, *Helisoma subcrenatum* (Carpenter), and water bugs *Sigara solensis* Hung. All these were plentiful. Amphipods *Hyalella azteca*, damselflies and dragonflies were found in small numbers.

There were no ducks on the lake. The nesting population of waterfowl, as observed, consisted of one pair of loons and an adult Holboell grebe with two half-grown young. One herring gull, one short-billed gull and four Bonaparte gulls were also seen.

Lacroix Lake: Situated five and one-half miles southeast of the confluence of the Bulkley and Telkwa Rivers, is tributary to the former. It is nearly circular in shape and about a mile across in any direction. The immediate surroundings are semi-open coniferous and aspen woods and agricultural clearings. The shores are mostly hard sand and gravel, the shore growth, chiefly alder and willow. A marsh belt of round-stem bulrush *Scirpus vallidus*, horsetail and spike rush is established around the entire shore in a belt of varying widths, and cattails grow under the shade of shore willows along the outlet creek and in small isolated clumps elsewhere. The duckweeds *Lemna trisulca* and *L. minor* are abundant in the marshes. A narrow strip of open water shaded by willows between the shore and the inner edge of the marsh contains a rich aquatic flora. In places sago pondweed is dominant, in others *Potamogeton gramineus*, or water smartweed, or arrowhead, or bur-reed is the chief or the sole growth. Other areas, larger than those dominated by a single species, contain a mixture of vegetation that includes hornwort, water buttercup and the pondweeds *Potamogeton natans*, *P. robbinsii*, *P. Friesii* and *P. richardsonii*. Yellow pond lily covers the lake surface in several places, and in deep water are forests of *Potamogeton amplifolius*.

Kamloops trout and suckers are reported to inhabit the lake; lake shiners were seen in shoals. Invertebrates collected were molluscs *Stagnicola palustris nuttalliana* (Lea), *Menetus exacuous megas* (Dall), *Musculium ryckholti* (Normand) and *Musculium securis* (Prime), the amphipods *Gammarus limnaeus*, *Hyalella azteca*, and odonata nymphs.

The waterfowl population is less than might be expected and certainly not commensurate with the supply of cover and food. A census taken July 14 follows: loon, 1 pair; Holboell grebe, 13 adults, 6 young; mallard, 3 females with broods numbering 6, 7, 8; baldpate, 3 females with broods numbering 4, 8, 9; surf scoter, 9; Barrow goldeneye, 1; long-billed dowitcher, 1; herring gull, 1; Bonaparte gull, 4.

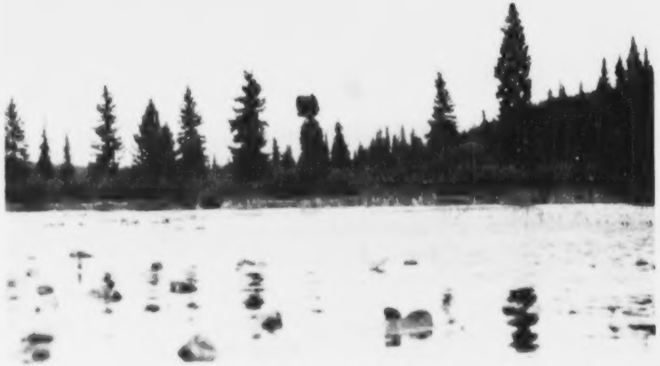
Small land birds were plentiful. Nighthawks and black swifts flew overhead, Brewer blackbirds hunted food on the shore, and red-winged blackbirds were accompanied by full grown young. At one place when the whistle of a pygmy owl was imitated numerous small birds came into an alder directly overhead. Amongst them were a pair of Bohemian waxwing, a pair of redstarts, a water thrush, a western tanager and a warbling vireo.

Covert Lake: About 1/4 mile long, 250 yards wide, in Lot 754 (Pre-emptor series, Map 3D, British Columbia Department of Lands), one-half mile south of Lacroix Lake. It is completely surrounded by black spruce forest and along the shores by floating bog covered with sedges, red osier dogwood and dwarf birch. The lake has a maximum depth of approximately 15 feet. The waters contain an enormous amount of the ivy-leafed duckweed that covers most of the bottom and reaches the surface in the shallower places where it is mixed with, or replaced by, lesser duckweed. Over about half the lake's area is a surface layer of the latter and a bottom layer of ivy-leafed duckweed. The only other food plant visible in this dense accumulation was a small amount of *Potamogeton robbinsii*. Adult damselflies were noted as relatively common, and dredging brought up leeches, amphipods *Gammarus limnaeus* and *Hyalella azteca*, the snails *Helisoma subcrenatum* (Carpenter) and *Physella ampullacea* (Gould), waterbugs *Notonecta kirbyi* Hung. and mayfly nymphs.

Waterfowl observed were: mallard, female with brood and 1 eclipse male; baldpate, 2 females with broods; bufflehead, 3 yearlings.

Like many lakes in the district, this is a feeding ground for transient waterfowl and is described as one of the best local duck-shooting places. Lakes where lesser or greater duckweed is abundant usually are frequented by pond ducks in the early autumn and no doubt this food is the attraction here.

Maclure Lake: 2 1/2 miles long, 1/2 to 3/4 mile wide, three-quarters of a mile east of the confluence of the Bulkley and Telkwa Rivers. The coniferous forest surrounding the lake is partly cleared, the logged-off portions grown up with deciduous trees, chiefly aspen; tall willows are prominent in depressions. On the east side the land rises to a low mountain of which part is forest of the prevailing type, part hayland and tillage. Except for half a mile or less on the west shore of open, hard beach fringed by alder and willow, the entire lake margin carries marsh growth varying in width from 50 feet to 100 yards. This is composed chiefly of round-stem bulrush and cattail, for the most part in separate beds but in several places these two plants occur in about equal proportion. A marsh of several acres at the north end has a navigable



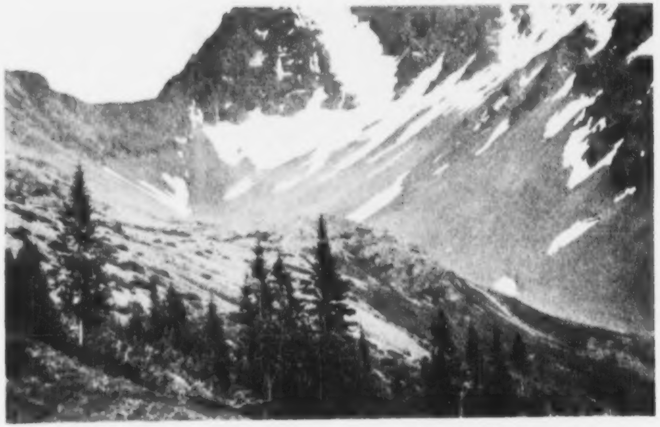
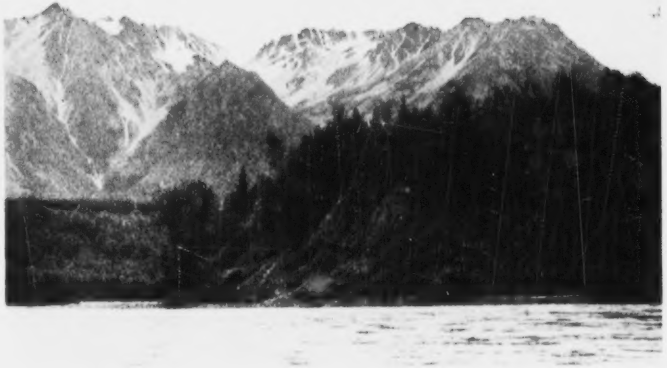


Fig. 30. Shore line, south end Maclure Lake; note large "witch broom" on top of spruce.

Fig. 32. The last trees in Red Rose Basin, Rocher Deboule.



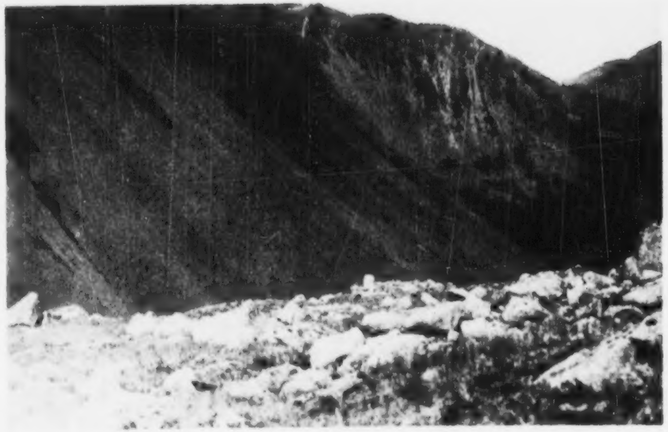


Fig. 31. Rocher Deboule Mountain from Hazelton.

Fig. 33. Alplands and shale slope on Rocher Deboule.

channel into it. Near the south end for a distance of 300 yards the lake narrows to a width of about 35 yards, the shores are boggy and black spruce is the chief tree growth (Fig. 30). At its extreme end is the outlet, a small creek that drains into the Bulkley River.

The main body of the lake is deep but shallows extend out from the shore in a number of places for 50 yards and more. In these shallows are numerous pondweeds and other aquatic plants in large quantities, the species noted being sago pondweed, the pondweeds Potamogeton natans, P. robbinsii and P. praelongus, bladderwort, water buttercup and mare's tail. Muskgrass covers parts of the bottom where the depth is 10 feet or less and along the inshore portions water smartweed, arrow-head and bur-reed are plentiful.

The lake is said to contain Kamloops trout, suckers and ling; large shoals of lake shiners were seen. Snails seemed to be the most abundant form of animal food. Amphipods and insect larvae were not found in large amounts, and damselflies were scarce.

Maclure Lake would seem to have the requirements necessary for a large population of nesting ducks. One place in particular is an 'island' of round-stem bulrush about 300 yards by 50 yards situated close to the west shore. Here the bottom is hard, the water shallow, and dead rushes in combination with tall new growth provide the type of cover that might be expected to attract mallard and several species of diving ducks. Nevertheless, this, and other similar areas around the lake, apparently were unoccupied. The entire waterfowl population, so far as could be determined, consisted of the following: loon, 4 pair and 2 young; Holboell grebe, 8 adults and 3 young; mallard, 1 male and 5 females, apparently without broods; ring-necked duck, 5 adults and 1 brood; canvas-back, 1 male; American coot, 2; Virginia rail, 3; herring gull, 1; Bonaparte full, 5.

Sloughs on Bulkley River: A number of winding backwaters from the Bulkley River provide resting places and breeding grounds for ducks; one such close to Smithers is typical of others. This is about one-half mile long and 20 to 30 yards wide. It winds through a depression in the river-flat amongst tall cottonwoods; alders and willows grow along the edge marking the line of high-water mark. The shallow waters contain a mass of pondweeds and other aquatic vegetation.

In the evening of July 17, a brood of ten baldpate, several female mallard and a female green-winged teal that probably had a brood concealed nearby, were under observation.

Hazelton Region

The region about Hazelton is well populated with small land birds but lacks waterfowl habitat, as is attested by H. S. Swarth's paper (Birds and Mammals of the Skeena River Region, Univ. of Calif., Pub. in Zoology, Vol. 24, No. 3, 1924). One section visited, on the Indian Reserve at the confluence of the Bulkley and Skeena Rivers, seemed particularly attractive to small land birds. This was a portion of the river-flat where wild cherry, black hawthorn and tall willows provided cover. Here on July 25 were identified olive-backed thrush, yellow warbler, Macgillivray warbler, redstart, western tanager, white-crowned sparrow, Oregon junco and song sparrow.

A triangle of low-lying land between the rivers is remarkable for the height and girth of the cottonwoods that grow there. These woods also contained many land birds. Along the river shore crows and a herring gull were attracted by a salmon carcass, and spotted sandpipers were seen.

There are several small lakes in the Skeena River valley said to be of similar character. Of these, the largest, Seeley Lake, was visited on July 24.

Seeley Lake: 1/2 mile long, 1/8 to 1/4 mile wide, is situated about three and one-half miles south of the confluence of the Skeena and Bulkley Rivers, and is tributary to the first. It is shadowed by the vast bulk of Rocher Deboule Mountain, and is fed by mountain streams. The water is shallow but cold and contains a population of cut-throat trout. The bottom is chiefly marl but along shore are marshes of round-stem bulrush and cattail. Most of the submerged vegetation, that includes water buttercup, water milfoil, sago pondweed, Potamogston gramineus and P. richardsonii, grows close to these marshes. There also are beds of yellow pond lily and patches of bur-reed. Amphipods Gammarus limnaeus are plentiful; a clam and several caddis larvae were collected, and it was observed that damselflies were more common here than about the lakes in the Bulkley Valley.

Waterfowl observed on July 24 consisted of loon, 1 pair; mallard, 1 male; ring-necked duck, 1 young about half-grown; Barrow golden-eye, brood of 9; hooded merganser, 2.

It may be of interest to note that the records of herring gull, ring-necked duck, Barrow golden-eye, and hooded merganser constitute additions to the list of species observed by H. S. Swarth.

Rocher Deboule Mountains: This mountain range is situated in the wide loop formed by the Bulkley and Skeena Rivers. It is the most prominent feature in the scenery south of Hazelton (Fig. 31). A road leads from Skeena Crossing to a mine in the Red Rose Basin, on the south side of the range at the head of Juniper Creek. From the lowest points, approximately 800 feet altitude, to timberline at approximately 4,000 feet the road traverses a succession of forest types in the following order, viz.: 1, aspen with some lodgepole pine; 2, black cottonwood, western birch, alder and, along the creek, heavy shrubbery of red osier dogwood, tall willow and hazel Corylus californica; 3, western red cedar Thuja plicata, western hemlock Tsuga heterophylla, and Engelmann spruce; 4, western hemlock and alpine fir; 5, dark, cold forest dominated by alpine fir; here snow banks from avalanches may lie all summer.

A semi-circle of seven peaks encloses Red Rose Basin on three sides. The opening of the cirque is to the west and from the alplands at 5,000 feet altitude can be seen, far below, the valley of the Skeena River. From the head of the basin, a stream rushes down over the narrow boulder-strewn bottom of a small valley. Northward above this stream the steep side of the valley is timbered for a mile or so along its base with alpine fir (Fig. 32). Above this line of forest for 1,000 feet or more the mountain side is part rock slide, part open, grassy slopes on which are many thickets of willow, mountain ash, dwarf juniper and procumbent alpine fir. Flowering plants such as Indian helebore, monkshood Aconitum sp., arnicas and erigerons reach their highest development here, more particularly alongside the little rills that rush down the mountain side and for the most part are invisible amongst dense foliage. Above this belt of vegetation are stretches of alpland without shrubbery and with a more strictly alpine flora, including dwarf spirea Spireae pectinata, numerous saxifrages, gentians, veronicas, moss campion and many other species. Specimens of the following plants were collected on this mountain:

Carex mertensii, Salix arctica, Oxyria digyna, Polygonum viviparum, Rumex acetosa, Silene acaulis, Aconitum delphinifolium, Arabis lyrata var. glabrata, Cardamine pennsylvanica, Draba sp. Rhodiola integrifolis, Saxifraga ferruginea, Saxifraga tricuspidata, Tellima grandiflora, Potentilla diversifolia, Rubus pedatus, Geranium erianthum, Epilobium anagallidifolium, Pyrola minor, Gentiana glauca, Campanula lasiocarpa, Hieracium gracile, Veronica alpina var. unalaschkensis, Erigeron peregrinus sp. callicanthemum, Solidago multiradiata, Arnica latifolia, Circium edule, Prenanthes alata, Artemisia arctica.

Above the alplands the mountain side is chiefly shale to the base of a surmounting crest (Fig. 33). To the south, on the opposite side of the little valley, shale slopes, burgundy red in colour and striped with ribbons of green vegetation, rise steeply from the creek bottom to the bases of precipitous cliffs. The highest part of the escarpment, that to the southeast, has a deeply-toothed crest and between two of the teeth lies the lip of a glacier; the slopes below carry snow all summer (Fig 34).

Bird life in the cold alpine forests was decidedly limited, the only species recorded being golden-crowned kinglet, American robin, winter wren, pine grosbeak and pine siskin. On the open slopes above, Oregon junco and golden-crowned sparrow, the latter feeding young, were abundant. On the alplands were broods of blue grouse, white-tailed ptarmigan and pipit.

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SUMMARY OF WATERFOWL OBSERVATIONS

The regions visited in central British Columbia contain many lakes, large and small, as well as sloughs, marshes and ponds. While many of these waters obviously do not fulfill the requirements of waterfowl reproduction others as obviously do. A number of places visited contained in varying degree the cover, the plants and the animals sufficient to provide nesting protection and food for relatively large populations of diving ducks, pond ducks and coots. At no place, however, could ducks be described as plentiful, and coots were rare. The only difference noted between nesting grounds of the best types here and in the Cariboo Parklands, where waterfowl are relatively abundant, was in the water itself. Equipment for making pH determinations was not available but it was obvious that waters in this section are soft (acid), while those in the Cariboo Parklands are alkaline, some strongly so. For the most part, the shallow alkaline lakes of the latter region occupy depressions in the flat or rolling grasslands. There is no counterpart of these conditions in central British Columbia. There, most of the open flat areas contain muskeg and the boggy-shored lakes associated with that type of habitat. The nearest approach to conditions as exemplified by the Cariboo Parklands is along part of the north shore of Francois Lake, and this incidentally contained the largest waterfowl population units.

Mallard was the most common and widely distributed species; other ducks in order of their abundance were baldpate, ring-necked duck, lesser scaup duck, buffle-head, Barrow golden-eye, and green-winged teal. A pair of blue-winged teal, nine cinnamon teal and seven shoveller, four of the last probably being transients, were observed at different times in the region adjacent to Quesnel and west of that place. None of these species was recorded in more northern latitudes. Redhead and ruddy duck were absent and only five canvas back, 4 males and 1 female, were observed during the entire season. Coots were conspicuously absent on most marshes and represented by only a few pairs on others.

The absence of redhead, canvas-back, ruddy duck, the absence of blue-winged teal and cinnamon teal except in the most southern parts, and the rarity of the coot might be explained by the fact that the region generally is beyond the range-periphery of the species as developed west of the Rocky Mountains. What limits their expansion in space cannot be explained by the presence or absence of any known physical factors. Perhaps it may be attributed to physical elements or limitations inherent in the species themselves. In contrast it can be observed how the mallard has expanded over the continent from California to Alaska.

The absence of pintail and shoveller (species that nest in Alaska and the Yukon) as nesting elements in the population is even less readily accounted for. It might be suggested that duck populations within more or less definite geographical boundaries are static in that they do not expand beyond those boundaries. The size of the population rises and falls in response to conditions of water and food, and in response to other factors that may be favourable in some years and unfavourable in others. Natives of any given area and their increase return to the same area each year (the recovery of banded mallards and pintails shows that units of population travel together in successive years), and if conditions are unfavourable some may not breed, or nest unsuccessfully, but nevertheless few or none seek more favourable conditions outside the boundaries of the region to which they are native.

Certain lakes and marshes of central British Columbia which are relatively barren of waterfowl in summer attract large numbers of ducks and geese during migrations. Many observers have reported this in respect of particular waters such as Bulkley Lake, Francois Lake and the Nechako River.

Nesting grounds north of the region explored, in which river margins figure prominently, are reported by travellers as populated chiefly by Canada goose, mallard, and American merganser.

Finally in summary it may be said that one of the most interesting facts brought out by this investigation is that many waters in central British Columbia suited to waterfowl propagation have insignificant populations or are entirely devoid of waterfowl.

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ANNOTATED LIST OF BIRDS

Loon--Gavia immer (Brünnich).

Loons were present on many of the lakes visited. No particular effort was made to locate nest but during the course of lake surveys four were examined. The particulars concerning the nests and the behaviour of the parents upon being disturbed are as follows:

Tiltzarone Lake--May 17: Nest a depression, containing a little water moss, on an old muskrat house made of sedge at outer margin of narrow lakeshore marsh. The single egg was sunk in the water so that only the upper surface showed. An adult was close to the nest and had recently been on it as the egg was warm.

Quanstrom Lake--May 17: An adult sitting on a nest similar in composition and site to the above was not disturbed.

Bouchie Lake--June 6: Nest 18 inches in diameter of dry cattails built on the flattened edge of a large muskrat house of the same material, situated at the edge of a cattail marsh on the lakeshore (Fig 35). Between the nest and open water were scattered round-stem bulrushes. One egg was pipped and the chick's bill visible through the half-inch aperture--its 'peeping' could be heard at a distance of six feet. Neither of the adult loons had been seen during the time I was paddling towards, and then examining, the nest. Shortly afterward one adult appeared about 20 yards away; she dived several times and remained silent until I paddled away, then the laughing call was made once. This was at 11:00 a.m. At 3:00 p.m. I paddled directly towards the nest and upon drawing near could see that a loon was on in with neck draped over the edge. When I was about 25 feet away it surged across the water, using both wings and feet and with body flat on the surface, for about 60 feet beyond the outermost rushes. There it called excitedly and charged over the water but in a nearly upright position with chest thrust out. The other member of the pair swam rapidly in, from a distance of 200 yards perhaps, and for the following ten minutes the two birds swam and dived close to my canoe, as it drifted along the edge of the rushes. The bird which had been incubating was noticeably the larger of the two; it was the more aggressive and continued making various demonstrations, as for example, standing upright with head forward and chest out; standing nearly upright with head forward and wings partly open; advancing with wings half open; in partly upright position stretching and shaking wings. Note that in Fig 36 the nearer loon (the one which was on the nest) has the bill open in the act of calling.

The other bird was silent. As I paddled out from shore, after determining that the pipped egg was not hatched, the larger bird accompanied the canoe for several hundred yards then rushed over the water back to the nest.

On June 8 at 2:00 p.m. one egg was hatched, the other pipped. Both adults remained close to the nest; both gave the laughing call almost continuously but only the larger one displayed. The chick scrambled out of the nest and although I put it back several times it finally swam out and joined the adults, and all three moved off. An hour later the pair was a mile from the nest, the young one riding on the back of the larger parent. All that evening both adults, on a distant part of the lake, were very noisy; neither returned to the nest. Until 8:30 p.m., at least, the chick in the egg was alive and could be heard peeping. How long it survived was not determined; when the nest was again visited at 9:00 p.m. on the following day it was dead in the egg.

This family was observed several times until June 17. Usually the trio swam in single file with the young one in the centre, the adults modifying their swimming speed to that of the chick. On one occasion as I paddled across the lake, not attempting to overtake the birds, my course took me within 30 feet. At about this distance the larger bird rushed across the water then stood on its tail and called numerous times; the other loon called also but continued swimming in the normal manner.

The pair and the young bird were seen together on August 18, at 9:00 a.m. Later in the day the larger adult, accompanied by the young one now nearly full grown, were on the nesting territory and when I approached them the adult behaved as it had done at nesting time, swimming towards the canoe, calling repeatedly and performing the several actions earlier described.

Maclure Lake--July 15: Nest 30 inches in greatest diameter made of cattails including a few green stems, the top surface eight inches above the water--built at the edge of a cattail marsh on the shore of a narrow channel. It contained one egg. The loon was heard, but not seen, leaving the nest as I rounded a nearby point of the marshy shore. A few minutes later the pair was seen swimming on the open lake 100 yards distant. Neither made any demonstration. Such a late record for nesting and the fact of only one egg being in the nest suggest this was a second attempt. If so it represents an unusual instance. Three other pairs of loons were on this lake, two pair each with one young, and one pair without young. The last allowed me to paddle as close as 30 feet before they dived. They remained silent.

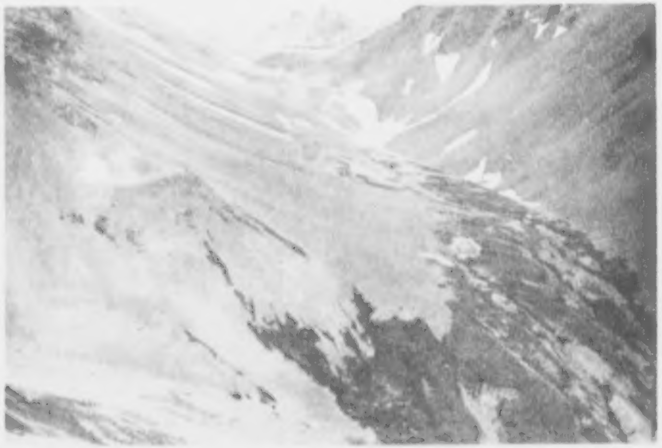
In reference to the account submitted regarding the family of loons on Bouchie Lake it has been emphasized that the parent observed incubating (the one which displayed and showed the most concern for the young) was the larger of the two. The difference in size was compared sometimes at a distance no greater than 10 feet. While studying loon populations it has been remarked numerous times that usually one parent rushed up to my canoe and made various demonstrations while the other swam off with the young. The explanation seemed to be that the behaviour of the first was indicative of the male parent, and the behaviour of the second indicative of the female parent. It is not known to me whether or not there is a constant difference in size between adult males and females. This, no doubt, could be answered by the measurement of sufficient properly sexed specimens. The question of which sex incubates the eggs could probably only be determined by collecting incubating birds as they left the nest--a task that few would care to undertake.

Observations here as elsewhere in British Columbia, suggest that not all adult loons breed, that some mated birds do not succeed in raising young, and that successful pairs are more often accompanied by one young than by two young. Considering only the populations observed from June 9, when most, or all the eggs should have been hatched, it will be seen (Table I) that a total of 42 adults succeeded in raising a total of nine young.

Table I

Loon Populations

Locality	Area of Lake	Date	No of adults	No. of young
Dragon Lake	3 1/2 × 1 M	June 9	4	1
Milburn Lake	1 × 1/2 M	" 10	1	0
Summit Lake	7 × 1 1/4 M	" 30	5	0
Chief Lake	3 1/2 × 2 M.	July 7	2	0
Nukko Lake	2 3/4 × 1 M	" 7	4	2
Seymour Lake	1 × 1/2 M	" 13	2	0
Lacroix Lake	1 × 1 M	" 14	2	0
Maclure Lake	3/4 × 3/4 M	" 15	8	2
Seeley Lake	1/2 × 1/4 M.	" 24	2	0
Bulkley Lake	2 3/4 × 3/4 M.	" 28	6	0
Shafer Lake	1 × 3/8 M.	Aug. 7	1	0
Bouchie Lake	1 1/2 × 7/8 M.	" 18	2	1
Edy Lake	3/4 × 1/2 M.	" 22	2	2
Quanstrom Lake	1/4 × 1/4 M.	Sept. 3	1	1
		Totals -	42	9



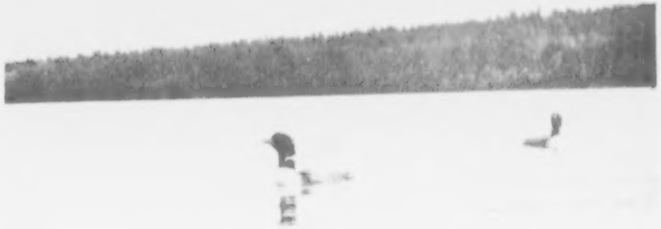
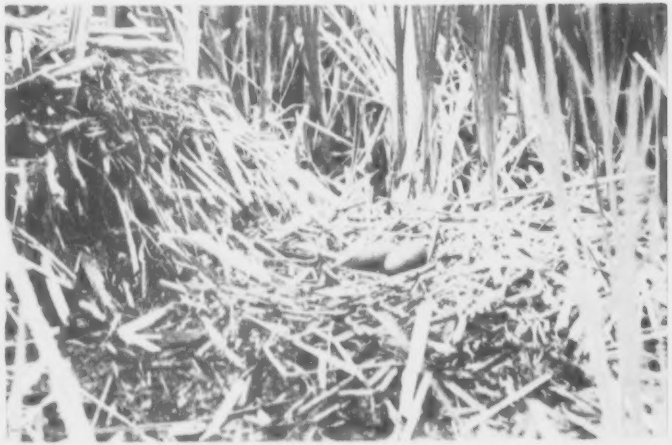


Fig. 34. The head of Red Rose Basin, Rocher Deboule.

Fig. 36. Pair of loons, close to nest, Bouchie Lake, the nearest loon is calling.



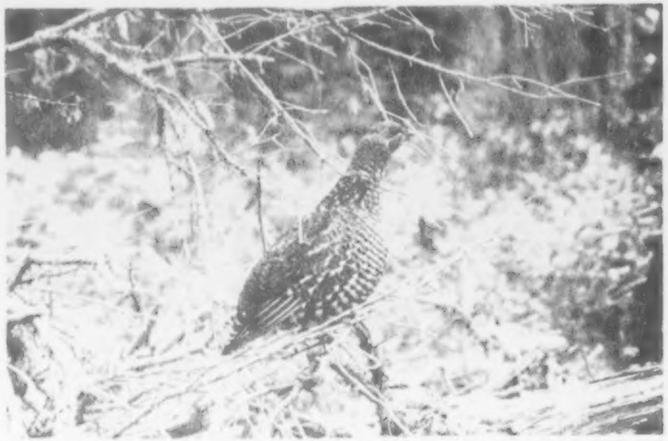


Fig. 35. Loon's nest on muskrat house, Bouchie Lake.

Fig. 37. Franklin Grouse, Summit Lake.

Several observations show that parents remain with the young until it, or they, are nearly full grown. Both parents accompanied a young bird on Bouchie Lake at least as late as August 18, and a pair accompanied two young on Edy Lake at least as late as August 30. However, at Quanstrom Lake on September 3, a young bird was accompanied by only one parent.

Arctic Loon--Gavia arctica (Linnaeus).

Mr. C. D. Muirhead made note of a small loon with patch of white on the head swimming in an open stretch of water in the Bulkley River during the winter of 1933-34. The arctic loon is known to occur as a transient in central British Columbia so that this sight record based on the above description is considered acceptable.

Red-necked Grebe (Holboell Grebe)--Colymbus grisegena (Boddaert).

This was the commonest grebe and was found nesting, or accompanied by young, on many of the lakes visited. At Puntchesakut Lake several were heard calling on May 7, and thereafter some were seen or heard daily until I left the region on June 5. It was still conspicuous when I returned there at the end of August. The majority on this lake were transients associated with other migrating grebes and diving ducks that assembled usually far out from shore. The largest numbers seen together in one day were 12 on May 24 and 25± on September 3.

Two pairs nested on the lake and these were together on their territories as early at least as May 10. The territory in each instance consisted of a small bay with a sedge marsh at the end. One nest, about 18 inches in diameter, made of rotted sedge and some water moss, floated amongst new growth of sedge about 10 feet from the outer edge of the marsh. It contained one egg on May 27. This nest was deserted and the pair built another one of the same material 14 feet from the first in a situation that seemed identical, except that the nest rim at most of its circumference touched or overlapped yellow pond lily leaves. It contained one egg on May 30. Another nest identically constructed, and empty on May 28, was built up from the root system of a sedge clump. It also was surrounded by yellow pond lily leaves.

Pairs of Holboell grebe, undoubtedly nesting, were found on other lakes in the Baker Creek region, namely, Tiltzarone Lake, Puntataenkut Lake and an unnamed lake on Puntataenkut Creek. Five were counted on Bouchie Lake, June 8, and an empty nest was examined there. On Nukko Lake it was the commonest waterfowl, the population being at least nine pair. Each of several small, marshy bays, and less definite areas along a shoreline marsh of bulrush or horsetail, constituted a territory. Each of two pair was accompanied by two large young on July 8, the remainder appeared to have lost their young.

On Lacroix Lake also it was the commonest waterfowl. The population as counted on July 14 consisted of the following: 1 pair and 2 large young, 1 pair and 2 medium-sized young, 1 adult and 2 small young, 1 adult disturbed from nest, flock of 7 adults. The last very likely was made up of the missing members of pairs noted above together with pairs that had lost their young. The nest referred to, made of rotted bulrush, contained three eggs and in the water close by a recently-hatched chick was swimming. The adult, when disturbed from the nest, swam under water through an open stand of rushes, about 60 feet wide, and reappeared on the open water beyond.

The population on Maclure Lake, as counted on July 14, comprised five single adults, each of which swam out from different areas of marsh along the lakeshore, and three adults each with one young. At Shafer Lake, where one was heard, the finding of two eggs floating in a weed bed indicated an unsuccessful nesting.

Table II

Nesting Population of Holboell Grebe

Locality	Area of Lake	Date	No. of adults	No. of young
Nukko Lake	2 3/4 × 1 M.	July 7	18	4
Seymour Lake	1 × 1/2 M.	" 13	1	2
Lacroix Lake	1 × 1 M.	" 14	13	7
Maclure Lake	3/4 × 3/4 M.	" 15	8	3
Bulkley Lake	2 3/4 × 3/4 M.	" 28	2	0
Shafer Lake	1 × 3/8 M.	Aug. 7	2	0
Tiltzarone Lake	1 × 1/4 M.	" 31	2	0
		Totals	46	16

Horned Grebe--Colymbus auritus **Linnaeus**.

Single birds were seen on Tiltzarone Lake, May 7 and May 17. On Puntchesakut Lake, May 11, a flock of 17 associated with the transient congregation of diving ducks and other grebe referred to earlier. The following day seven were present, and two were seen on May 24 and May 27.

At least two pair nested on the small, marshy Stanyer Lake near Francois Lake, where on August 1, two or more adults in worn plumage and six to eight nearly full grown young, as yet unable to fly, were observed. This population again came under observation during the following week when on one occasion all of its members accompanied a flock of young lesser scaup duck. On August 12 a single bird, perhaps one of those raised on Stanyer Lake, alighted on Keefe Lake, that is about a mile distant. On August 2 two fully grown young were seen on a five-acre pond east of Ootsa Lake settlement. The foregoing are the only instances of personal observation; the species would appear to be less common in central British Columbia than in the Cariboo region to the south.

Western Grebe--Aechmorphorus occidentalis Lawrence.

Seen only on Puntchesakut Lake and as follows: May 11, 2; May 24, 31; May 26, 10±, May 29, 1; June 1, 11; September 2 to September 6, 2. Those recorded in May usually consorted with a raft of diving ducks, as was stated earlier.

Pied-billed Grebe--Podilymbus podiceps Linnaeus.

One or more was heard on May 31 on the Puntatenekut Creek expansion; two were heard on Dragon Lake, June 7, and one was seen, August 2, on a beaver pond on Shelford's farm northwest of Wistaria, Ootsa Lake. Evidently this grebe is much less common here than it is in the Cariboo Parklands

White Pelican--Pelecanus erythrorhynchos Gmelin.

Reports of the occurrence of white pelicans as detailed below were received from local residents.

Pelicans formerly frequented, and were thought to nest on, Pantage Lake (known also as Swan Lake, Pelican Lake, Musquash Lake) 2 miles long, 1 1/4 miles wide, situated south of the West Road River about 40 miles northwest of Quesnel. The pelicans abandoned the lake when the level was raised in connection with its development as a muskrat farm (G. R. Baker).

Pelican Lake, 2 miles long, 1/2 to 1 1/4 miles wide, north of the West Road River and tributary to Nataniko Creek is a resort for a small number of pelicans that apparently do not nest there.

An island in Tzenzaicut Lake is reported on the authority of Indians and trappers to be the site of a nesting colony (O. Mottishaw). This lake, altitude 3,675 feet, 4 miles long, 1/2 to 1 1/2 miles wide, is at the head of Merston Creek and about 17 miles west of the Fraser River at Alexandria.

Pelicans used to frequent Puntataenkut Lake up to about six years ago when the outlet was dammed and the lake level raised in connection with a power project.

A white pelican banded at Molly Lake, Yellowstone National Park on July 23, 1933 was shot on the Tachie River by an Indian on May 19, 1936.

Great Blue Heron--Ardea herodias Linnaeus .

Evidently a fairly regular visitant in summer. Muirhead reports seeing it at Toboggan Lake and Lacroix Lake. Mr P Brown recorded "at least 14" near Vanderhoof in 1943. One was found dead on the Bulkley River close to Bulkley Lake in December, 1942, and Dr. Baker reports seeing one each summer for a number of years at Sixteen Mile Lake.

American Bittern, Botaurus lentiginosus (Montagu).

One was heard at Dragon Lake, June 9, another at Ten Mile Lake, June 20; one was flushed from a marsh at Chief Lake on July 6, another from a marsh at Nukko Lake on July 7. It is reported also from Puntataenkut Creek and Bouchie Lake. Mr W. Armstrong found a nest with eggs at the last place several years ago

Whistling Swan--Cygnus columbianus (Ord).

Known to be a regular spring visitant to many of the lakes and rivers of the region; in the spring of 1944 large flocks which passed over Quesnel were seen by many people. At Francois Lake Mr. J Sugden counted 75 on April 21, 1943, and 100± on October 20, 1944 On October 19, 1944 Muirhead saw flocks totalling 100 to 125 flying in a southeasterly direction over Babine Lake.

Trumpeter Swan--Cygnus buccinator (Richardson.

The trumpeter swan is a regular winter visitant to a number of widely separated places, where lake outlets and rapids remain open, in the central interior of British Columbia. The majority frequent waters in the Provincial Electoral District of Omineca. Records relating to one band, which in some years contains 100 or more individuals, were obtained as early as 1923 It is usual for a number of swans to arrive on this wintering ground in November and if the winter is severe others appear later, when the more northern rapids freeze. The total present in 1944-45 was estimated to be 150. Another population, totalling 162 when a census was taken in 1945, is made up of a number of units that frequent various stretches of open water within an area approximating 5000 square miles. During the past four years a third band, which varied in number from 15 to 24, has occupied a river habitat close to a settled community. A fourth band, sometimes containing 20 or more birds, has long used a river in the Provincial Electoral District of Cariboo.

Much less is known concerning the nesting of trumpeter swans in Central British Columbia. An Indian told me that in May, 1939, he discovered a swan incubating six eggs in a nest built on top of a beaver dam There are several accounts current of swans observed in summer; in two instances these were accompanied by cygnets However, most of the Indians and woodsmen with whom I talked stated that all the swans fly north in the spring. It is of interest to note that trumpeter swans have been observed on migration as far north as Tetana Lake on the Driftwood River which is close to 56° north latitude (8)

Greater Canada Goose--Branta canadensis (Linnaeus)

Two pairs of Canada geese were present on the expansion of Puntataenkut Creek, May 16, but neither pair acted in the manner of nesting birds. Other pairs were seen several times in flight over lakes in the Baker Creek Valley, but this region is not well populated. The species is reported to nest more commonly in the Nazko country farther to the west. The main nesting grounds, however, are along the many northern rivers that in places travel through flat areas of muskeg, meadow and willow swamp. Numerous reports of these nesting populations have been received.

Thus Mr. J. B. Hooker estimates the number nesting each year along 20 miles of the Torpy River to be 20 pairs. Mr. J. S. McAllister, fire ranger at Aleza Lake, reported seeing, in the spring of 1944, approximately five pairs along 10 miles of the McGregor River. Mr. Martin Shafer estimated the population along 30 miles of the Salmon River to be 12 pairs in May, 1944. Reports also mention Stuart River and Fulton River between Chapman Lake and Fulton Lake, a tributary to Babine Lake, as nesting places. Mr. Clifford MacNeill saw 150± adults and young on a seven mile stretch of Tahtsa River, while coming down this stream by boat on August 1, 1944.

Both the spring and autumn migrations are reported to be of large proportions, particularly at Bulkley Lake, Ootsa Lake and in the region about Vanderhoof. Canadae geese commence to gather on the Nechako River near Vanderhoof in late August; a total of 45, standing on gravel bars within the recently established bird sanctuary at that place, was counted on August 15. Mr. P. Brown estimated, on September 21, that close to 1,000 were congregated within this sanctuary. Mr. J. Sugden reported that in 1944 geese remained at Francois Lake until December 15.

Lesser Canada Goose--Branta leucopareia (Brandt).

This is a common transient in south central British Columbia, its spring migration later than that of canadensis by several weeks at least. Undoubtedly its status in more nothern latitudes is the same. A flock of 40 identified as of this species passed over Puntchesakut Lake at 8:00 p.m. on May 9.

Cackling Goose--Branta minima (Ridgway)

This small and easily distinguished goose is a common transient both spring and autumn. It is know to local residents as 'brant' and by this name reported from many places between Quesnel on the east and Smithers on the west. A specimen taken at Ootsa Lake has been examined. The last of the migration had probably passed when

I reached the Baker Creek region on May 6. Mr. Julius Quanstrom told me that a flock of 20 had been seen there on May 4, flying low over Puntchesakut Lake.

At Francois Lake in the spring of 1943 a flock of geese, chiefly brant, that is cackling geese, remained until June 5. They were quite tame and fed alongside domestic geese and chickens (personal letter from J. Sugden). 'Tameness' seems characteristic of cackling geese in spring and has been observed elsewhere.

White-fronted Goose--Anser albifrons (Scopoli).

Between May 2 and May 5, 1933, a single goose, identified as of this species, was observed feeding with a flock of snow geese on Timothy Hill near Telkwa and on May 29, 1944, seven in company with four geese of the canadensis type were observed on a meadow near Smithers. Both records are those of C. D. Muirhead. Other less exact accounts concerning the occurrence of this goose in central British Columbia have been received.

Snow Goose--Chen hyperborea (Pallas).

There appears to have been an unusually large and wide-spread spring migration of this species through central British Columbia in 1944. Snow geese were observed early in May at several places in the Cariboo Parklands and a number of residents there reported seeing 'white geese' for the first time. Farther north a flock of 11 alighted on the meadows on Trueman's ranch at Dragon Lake on April 30 and were still there when I visited that place on May 6. Mr. Trueman told me that he first saw snow geese at Dragon Lake in the spring of 1940 and that each year since a few have visited his meadows in spring.

A Nazko Indian, Jimmy Lick, reported that early in May, 12 white geese had been on Speer's Lake which is about 50 miles west of Quesnel. He had never seen snow geese before and took them for swans or pelicans until he came close to them--he said.

Mr. R. F. Corless, who operates a river freight service to Fort MacLeod, saw 30 'waveys' on Summit Lake early in May. Later these, or other snow geese, were seen 18 miles north on the Crooked River and still later at Fort MacLeod.

Mr. J. S. McAllister reported the presence of a flock, that at one time contained 117, on Aleza Lake between May 1 and May 20.

Another report refers to seven on the Clark Ranch at Bulkley Lake in early may, and Mr Clifford McNeil saw a small flock on the Tahtsa River during the first week in May.

Mallard--Anas platyrhynchos Linnaeus.

A population of mallards is widely distributed geographically and also in respect of habitat but nowhere is the species particularly common in summer It is an abundant transient and the numbers comprising both spring and autumn flocks are said to be impressive. Mr. J. Sugden, in a personal communication, gives an estimate of 1,500± at Francois Lake on April 21, 1943.

Each of two pairs under observation at Puntchesakut Lake occupied territories about one-half mile apart that consisted of a small sedge marsh and narow marshy bay The male and female of one pair were seen together daily, or the male alone on the territory awaiting the female, until May 13--after that date the female disappeared and presumably was incubating. On May 17 the two males were seen together for the first time.

Females with broods of young inhabited lakes and marshes of many different types; a single brood sometimes representing the entire waterfowl population of a pond or even that of a fairly large lake The first brood of downy young was recorded on June 6 at Bouchie Lake The average number of young in 11 broods, counted between June 6 and July 15, was 9.1. The average number of young in five broods counted between July 30 and August 8 was 5.4. The earliest brood of flying young was noted on August 4 at Keefe Lake

The first post-breeding flock of males, in this instance 35, was observed at Puntatenkut Creek on May 31 These were in various stages of the moult to eclipse. Through the summer single eclipse males and small flocks up to 15, in several instances including a few adult females, were noted at various places No large flocks of post-breeding males came under observation. The largest population observed was at Shafer Lake where on August 7 approximately 50 adults and young were counted. Another small concentration of adults and young, some 40 birds, was seen on the Nechako River close to Vanderhoof on August 15 A month later, according to a reliable report, over 1,000 were using this area

It is stated by hunters that in the Vanderhoof region mallards do not visit the stubble fields in autumn to feed on grain as they now do regularly in the southern interior.

Mallards sometimes winter in these northern latitudes Thus at Francois Lake in the mild winter of 1943-44, when the lake did not freeze, a number were seen there (personal letter from Mr. J. Sugden). Another instance of mallards wintering was reported by Constable E. Forfar, who on January 5, 1927, counted a flock of 23 on an open creek near the east end of Stuart Lake.

Pintail--*Anas acuta* (Linnaeus).

Reported to be common during an early spring migration and an autumn migration. A flock of eight in a flooded meadow at Dragon Lake, May 6, probably were late transients. No evidence of nesting was obtained. Details concerning the small number met with during the summer are as follows: Five adult males in partial eclipse at Dale Lake, June 20, were "dipping" in the shallows and rose with some difficulty when flushed. They circled the meadow several times then slanted down and alighted again on the water. Other observations were: a female on a beaver pond at Ootsa Lake, August 12; two eclipse males on Stanyer Lake, August 1; an eclipse male on Keefe Lake, August 5, and two eclipse males on Tiltzarone Lake, August 31. All these were in flying condition.

Green-winged Teal--*Anas carolinensis* Gmelin.

The spring migration of green-winged teal was practically over when the investigation commenced, and the only ones seen that might have been transients were a trio of two males and one female at Puntchesakut Lake on May 31.

A brood of six about two-thirds grown at Stanyer Lake, August 7, and a flock of eight flying young, presumably a brood, on a pond near Ootsa Lake, August 2, were the only young observed. Other evidences of nesting were, a female on a slough near Smithers and another on a small pond near Bulkley Lake, both of which acted in the manner characteristic of females with broods.

A male and a female on Bouchie Creek, May 31, four eclipse males together on a beach at Bulkley Lake, July 31, and two adult females on Shafer Lake, August 17, concludes the list of records for the entire summer.

Blue-winged Teal--*Anas discors* Linnaeus.

A pair found nesting at Dale Lake, near Quesnel, is the only record. The nest, without down and containing two eggs on June 20, was situated in a tall and isolated tussock of timothy surrounded by short clover, 20 feet from the water in a cultivated field.

Cinnamon Teal--*Anas cyanoptera* Vieillot

A total of nine was observed in the Quesnel and Baker Creek region under the following circumstances, viz.; at Tiltzarone Lake on May 17, a mated pair slipped into the water from where it had stood on the edge of the muskeg shore then took wing, passed me at a distance of about 20 feet, and dropped to the water 30 yards away. On May 31 two males were flushed from a sedge marsh on Puntataenkut Creek. At Dragon Lake, on June 9, a trio of one male and two females, and later a male and female together, were flushed from lakeshore marshes.

Baldpate--*Mareca americana* (Gmelin).

Scarce in the Baker Creek and Quesnel regions, where only two mated pairs were recorded, and relatively more common at Francois Lake and in certain parts of the Bulkley Valley. It was not observed elsewhere. In numerical status it probably is next to the mallard. Actually more young baldpate than young mallard were observed, but this probably was due to the fact that the habits of the former are much less secretive and broods of all ages commonly frequent open water.

The average number of young in six broods counted between July 14 and July 17 was 7.5. Later the following were counted: one brood of 10 near Smithers, July 17; one brood of 4 on Keefe Lake, August 4; one brood of 5 on Stanyer Lake, August 5; one brood of 6, four females with 10 young, and a band of 70 composed chiefly of young, on Shafer Lake, August 7. The latter together with some 30 mallards were crowded on a small muddy beach and as I drew close to them the mallards took flight and the baldpates swam out on the lake through a surface foliation of pondweeds.

The behaviour of three females with broods, under observation at Lacroix Lake, July 14, differed in some degree from the normal which is to leave the brood, alight close to the observer and perform various actions--such as beating the water with the wings, and rushing over the surface. When discovered each of these females was leading her brood through an open marsh and upon being approached remained on the water in this cover for several minutes. Each swam back and forth, the feathers on the crown erect, and made a constant excited quacking. Meanwhile the young swam out on the open lake and not until they had travelled several hundred yards did the female join them. It was noted that one young in each of two broods swam in a direction opposite to that taken by the remainder that kept together in a tight bunch.

On the evening of July 17, in a backwater of the Bulkley River, a female and brood of 10 half grown young were detected swimming along the shore close to the base of a low bank. They swam in single file, the female leading, and maintained this formation while they travelled slowly for about 200 yards. Suddenly there was an explosion of activity as a horned owl launched out from the cottonwoods on the opposite shore and attempted to seize one of the ducks. The young scattered and disappeared in a cloud of spray; the female rushed across the water then swam about quacking vigorously.

When Keefe Lake was first visited, on August 4, it was seen that the few duck broods present, excepting two of flying mallards and one of six nearly full grown Barrow golden-eye, were unusually small. A baldpate had four, a lesser scaup duck, four, and a white-winged scoter only one young. All these were judged to be between two and three weeks old. In addition a female buffle-head, apparently adult, was without a brood. It seemed evident that the smallness of the broods was the result of predation, perhaps by a marsh hawk, the only predator observed in the vicinity. During the following five days the female lesser scaup duck and a number of young ducks, including the four baldpate, disappeared. On August 10 it was observed that the female baldpate had apparently adopted the two remaining young lesser scaup ducks. At any rate she swam beside them and was as assiduous in their defense--flapping across the water and performing other actions characteristic of the female and brood relationship--as she had been earlier in defense of her own young.

Shoveller--Spatula clypeata (Linnaeus).

Four males on a flooded meadow at Dragon Lake, May 6, and a male and two females on the expansion of Puntataenkut Creek, May 31, are the only records.

Ring-necked Duck--Aythya collaris (Donovan).

Present in small numbers on many of the lakes visited. Five or six males were conspicuous on Puntataenkut Creek, May 15, and on May 31 two pair and three apparently unmated females were seen there. At Dale Lake, June 30, ten adult males were on open water and amongst flooded willows along Sister Creek. Several stood on logs dressing their plumage while others dived for food. No females were observed. Two males and a female visited Bouchie Lake on June 5 and on the two successive days following. A population on Milburn Lake, June 10, consisted of a mated pair and four males.

The first downy young, a brood of four not accompanied by a female, were recorded at Swamp Lake on July 5. A brood of six half grown young on Tiltzarone Lake, also unattended on August 31, was probably the product of an unusually late nesting. The average number of young in six broods, counted between July 5 and August 31, was 5.6.

At Nukko Lake on July 7 a female and six downy young when first seen were at the lake edge of a horsetail marsh. The female rose, circled over my canoe several times, then alighted on the water. When I left the vicinity she flew to her brood that in the meantime had swam out on the lake.

The behaviour of another female and brood of eight met with near the same place two days later was quite different. She swam in a circle about the canoe, trailing her wings and striking them on the water; then she swam straight ahead keeping 20 yards or so in front of the canoe until she had reached a point 100 yards or more beyond where the young had disappeared into the marsh; she then turned and flew back to them.

A female at Maclure Lake, July 15, flew out from shore and alighted on the water where she made similar demonstrations. Then she travelled along shore in a direction opposite to that taken by the three-quarter grown young. These followed the shore, partly concealed by a thin growth of horsetail, for some 300 yards then three of them, that perhaps made up the entire brood, left the marsh and flapped over open water until well out on the lake. Here they dived, turned about, and in a succession of long dives returned to the shelter of the marsh.

Canvas-back, *Aythya valisineria* (Wilson)

At Puntchesakut Lake on May 11 three males and one female, obviously transients, accompanied a flock of surf scoters and other waterfowl congregated on the centre of the lake. A single male in partial eclipse was seen in flight at Maclure Lake on July 15. These represent the only records of the species made during the summer. C. D. Muirhead reports seeing flocks up to 50 at Kathlyn Lake, near Smithers, during spring migrations.

Greater Scaup Duck--*Aythya marila* (Linnaeus).

At Puntchesakut Lake on May 11 eight greater scaup duck formed a small unit in a flock of waterfowl gathered on open water. The species was not seen elsewhere.

Lesser Scaup Duck--*Aythya affinis* (Eyton).

Nesting populations were found only in the Baker Creek Valley and in the Francois Lake-Ootsa Lake section. In neither of these places was it abundant. The only record elsewhere was that of a female flushed from a marsh on Dragon Lake, June 9.

A population in an expansion of Puntataenkut Creek was estimated on May 31 to be seven pair. These were courting and making display flights.

At Tiltzarone Lake, May 7, a total of 40, and on May 17, a total of 60, were counted. On August 31 a count of 75 was made up of eight eclipse males, six adult females and 61 nearly full grown young--undoubtedly the product of pairs that had nested beside the lake. When first seen all were together, the majority standing on the boggy shore, the remainder close by on the water. Under observation the flock moved out on the lake and broke up into smaller units. The eclipse males appeared to be flightless and dived when approached as did most of the young, although some of these were able to fly. Later most of the various units came together and at one time 42 scaups swam along the lakeshore in single file. This population was the largest observed.

The next largest was on Shafer Lake where on August 7 the several age groups were identified as: 35 post-breeding, and (probably) yearling males, 5 yearling females, 2 adult females and 17 young. The adult males, yearling males and yearling females, when observed were travelling in one band, the adult females and young in another.

On the nearby Stanyer Lake a small number came under observation several times. On August 7 a female with brood of 12 was assiduous in defense of her half-grown young. This female was conspicuous by reason of a cream-coloured area extending over the face and neck. The population included also 19 other young and two or three adult females. On August 8 all of the young were in one band. Other breeding records are: a female with four young on the adjacent Keefe Lake, and a female with brood of 12 on a five-acre lake east of Ootsa Lake settlement. These extend the known breeding range in British Columbia some 150 miles to the north.

A second female, without a brood, on Keefe Lake was collected. It was in a wasted condition, the entrails and stomach contracted and the body cavity filled with what appeared to be degenerate fatty tissue. The stomach contained a small amount of food, the identifiable material being one damselfly nymph and 20 seeds of hornwort.

Barrow Golden-eye--Glaucionetta islandica (Gmelin).

Much less plentiful than in the Cariboo and south central British Columbia. Only three, all females, were recorded in early summer in the Quesnel and Baker Creek region, these being at Puntataenkut Creek, May 24, Bouchie Lake, June 5, and Dragon Lake, June 9.

The appearance and behaviour of the female on Bouchie Lake was studied several times at close range, once at a distance not more than 15 feet. This was near enough to see the characteristic bill shape of islandica which at this time was entirely without yellow. Her behaviour was that of an incubating bird during an absence from the nest, viz ; she dived for food along the shore, splashed in the water, then flew to a log on the shore where she thoroughly dressed her plumage. On June 17 this female, or another, was accompanied by five downy young thought to be about a week old.

A single female golden-eye seen in flight at Lacroix Lake, July 14, and another at Bulkley Lake, July 30, were probably of this species.

A female and nine half grown young at Seeley Lake, July 24; a brood of 11 half-grown young on Bulkley River, July 28; a female and brood of six nearly full-grown on Keefe Lake, August 4; a brood of four, another of six, on Shafer Lake, August 4; two young one-third grown on Francois Lake, August 8; an adult female on Tiltzarone Lake, August 31, and two full grown young on Puntchesakut Lake, September 3, complete the list of observations. The average number of young in six definite broods, observed between June 17 and August 8, was 6.5.

Buffle-head- Glauceonetta albeola (Linnaeus).

At Tiltzarone Lake, May 17, seven adult males were actively courting three females; on May 17 the population consisted of five pairs and at least six yearling females. Whether or not any nested there was not determined; none was present when the lake was next visited on August 31. At Puntchesakut Lake, May 11, one male and four females accompanied a gathering of waterfowl, and a pair visited the lake on May 16. Eleven were counted, May 31, on the Puntataenkut Creek Expansion.

At Milburn Lake, June 10, a male, alone and very quiet on what undoubtedly represented part of its territory, was joined by a female that obviously had come from her nest.

The only young recorded were a brood of six about three-quarters grown, on a beaver pond at Ootsa Lake, August 2, and approximately 20, none in definite broods, on Shafer Lake, August 7.

The following are records of non-breeding yearling males, and females identified as yearlings: Bouchie Lake, June 5, 2 males, 1 female; Dale Lake, June 20, 2 females; Swamp Lake, July 5, 1 female; Lacroix Lake, July 14, 2 males, 1 female.

At Keefe Lake, August 4, a female thought to be an adult was seen in company with a female Barrow golden-eye and her brood. The two swam abreast and in advance of the young. At Shafer Lake, August 4, an adult or yearling female led a brood of four Barrow golden-eye.

On the basis of the above enumeration the species cannot be described as plentiful in the portions of central British Columbia covered by this paper.

Old-squaw--Clangula hyemalis (Linnaeus).

At Puntchesakut Lake, sometime during the afternoon of May 23, a single male was attracted to a flock of surf scoters. It flew from place to place on the fringe of the flock and called several times, the musical notes travelling a long distance across the water. When swimming this duck rode high on the water with tail elevated; it was restless and the first to rise when I approached the flock. This is the only record.

Harlequin Duck--Histrionicus histrionicus (Linnaeus).

A pair seen on Puntchesakut Lake, May 11, was the only personal observation. Mr. C. McNeil reports seeing it on Whitesail River in spring, and C. D. Muirhead has seen them on Stuart River about five miles south of Stuart Lake.

White-winged Scoter--Melanitta fusca (Linnaeus).

The presence of this species on Puntchesakut Lake in company with surf scoters is referred to earlier. The precise dates observed and numbers recorded are: May 11, 25 males, 5 females; May 23, 23±; May 27, 2; May 28, 1.

At Maclure Lake on July 15 three males and two females were with a flock of 34 surf scoters on the centre of the lake. One of the female white-winged scoters was flightless, and the males probably were renewing the flight feathers as they seemed to experience considerable difficulty in taking flight.

A female on Keefe Lake, August 4, was accompanied by one young judged to be about three weeks old. It was observed on August 8 that the young bird had disappeared and that the female consorted with a brood of Barrow golden-eye. On August 9 a second female white-winged scoter appeared on the lake and was seen there again on August 12. Both times the two females were in company.

At Tiltzarone Lake, September 3, I paddled within 30 yards of a female and brood of nine about one-quarter grown. The female appeared unconcerned, even when approached a second time, and neither left the brood nor made any demonstration.

These records represent a considerable northern extension of the species known nesting range in British Columbia.

Surf Scoter--Melanitta perspicillata (Linnaeus).

A migration of surf scoters at Puntchesakut Lake has been referred to. The dates observed and numbers counted are: May 6, May 7, 30±; May 8, May 9, 25±; May 11, 60 males, 18 females; May 16 - 20±; May 20, none; May 21, 28; May 23, 100±; May 26, 35±; May 27, 26. The last record is for May 28 when two males were seen feeding close inshore.

Other spring records in the Baker Creek Valley are: two males on Quanstrom Lake, May 7; a flock of 10 on Puntataenkut Lake, May 20; a total of 20 on Tiltzarone Lake, May 6, and nine males and two females at the same place on May 16. Surf scoters were again observed on this lake when it was next visited August 31. On this date, four and on September 1, five, all females, were counted.

A flock of nine adult males on Lacroix Lake, July 14, and a flock of 34, chiefly males, on Maclure Lake, July 15, are the only mid summer records.

Hooded Merganser--*Lophodytes cucullatus* (Linnaeus).

Two females seen together several times on the water at Seeley Lake, July 24, and once examined at a distance no greater than 20 feet, represent the only personal observation. Mr. C. D. Muirhead reports seeing a female and brood during several successive summers on a small pond near Topley.

American Merganser--*Mergus merganser* Cassin.

Two adult males alighted on Puntchesakut Lake in the evening of May 9 and these, or two others, were seen near the same place at 7:00 a.m. on May 18. Subsequently until May 29 a flock visited the lake more or less regularly, usually in early morning or in the evening, and fished along shore, some swimming with head submerged in the manner characteristic of the species. The fishing ground was a shallow, shoreward area inhabited by large schools of lake shiner. A flock that appeared on May 26 consisted of six adult males and eight brown-headed birds, some of the latter definitely identified as females, others as possibly young males. The largest flock counted, May 29, contained seven adult males and 14 females and/or young males. Such a late date for mergansers to be in flocks suggest the possibility of these birds being post-breeding males and yearling males and females not in breeding condition.

Goshawk--*Accipiter gentilis* (Linnaeus).

Three adults and six young in the plumage of the first year were recorded at various places during the summer. In several instances only a momentary sight of the bird was obtained as it flew swiftly through the woods, others afforded more favourable opportunities for observation.

Thus at Nukko Lake, July 14, an adult male left a tree on the shore and flew out over the lake then, in a series of upward spirals, ascended to a considerable height. Several times he passed directly overhead and once climbed upward in such a manner that at one time or another the tail, the back, and the vermiculated under surface of the body came into sharp focus.

Near Smithers, July 17, when one in immature plumage was disturbed at the edge of a forest opening it flew out carrying some object which later it dropped. This proved to be a portion of a snowshoe rabbit, chiefly skin from the back and head with ears attached.

At Shafer Lake, August 7, one flushed from thick alders on the lakeshore and disappeared in the woods. Immediately afterwards two female mallards which had been concealed in a small patch of sedges directly below where the hawk had stood flew out from this hiding place.

Sharp-shinned Hawk--Accipiter striatus Vieillot.

One adult was seen at each of the following localities on the dates given, viz.: Puntchesakut Lake, May 21; Bouchie Lake, June 10, August 17; Ootsa Lake, August 4; Vanderhoof, August 15. At Puntchesakut Lake, September 1 and September 3, a young female was observed hunting along the lakeshore brush.

Swainson Hawk--Buteo swainsoni Bonaparte.

A mounted specimen, without data but reported as shot in autumn near Smithers some years ago, is in the collection of Mr. J. B. Langston. This is a bird of the year, apparently a male, heavily marked on the lower surface.

Rough-legged Hawk--Buteo lagopus (Pontoppidan).

A photograph of a bird of the year in the light phase, shot near Summit Lake about October 1, 1943, has been examined. There is a mounted specimen, shot in autumn some years ago near Smithers, in Mr. J. B. Langston's collection. This also is a young, light-coloured bird.

Golden Eagle--Aquila chrysaëtos (Linnaeus).

A mounted bird in the possession of Mr. J. B. Langston was shot about 1914 near the head of Driftwood Creek, about 15 miles north of Smithers.

Bald Eagle--Haliaeetus leucocephalus (Linnaeus).

For an undetermined numbers of years, according to local report, a pair has nested in the forest about one-half mile north of Puntchesakut Lake. The nest is situated close to the top of a tall Douglas fir, one of a group of three that rise high above the surrounding lodgepole pines. Foliage on all sides partially conceal the nest from the view of one standing on the ground. Above the nest the main trunk for its last eight or 10 feet is devoid of branches and undoubtedly this serves as a perch for the eagles. When the place was visited at about 10:00 a.m. on May 12, the female was on the nest. When the site was approached she launched out on the air, circled overhead, and whistled several times. Almost at once the male appeared and both remained in the vicinity flying above the tree tops.

A search for food remains under the nesting tree and the surrounding trees revealed only vertebrae and other parts of several suckers.

Single adults, very likely one or another of this pair, frequently were seen flying over Puntchesakut Lake. On May 16 one attempted to capture a Holboell grebe, swooping down to the water a total of eight times but each time the grebe dived before the eagle was within striking distance.

An adult at Dragon Lake, June 9, stood very straight in a tall dead fir that rose above lesser growth some 40 yards from the lakeshore. It did not fly when I passed close to the tree. Other adults in flight were recorded at Milburn Lake, June 10; Bouchie Lake, June 15 and Summit Lake, June 30. Still another at Swamp Lake, July 5, kept flying in circles, 60 to 100 feet above the water; it was being mobbed by eight Bonaparte gulls that continued in pursuit for the 10 minutes the eagle was under observation. A young bird, about a year old, at Chief Lake, July 7, another at Lacroix Lake, July 14, complete the list of observations.

Marsh Hawk--Circus cyaneus (Linnaeus).

Adults were recorded at Puntchesakut Lake, May 12, May 18, May 29; Puntataenkut Creek, May 16; Maclure Lake, July 15; Bulkley Lake, July 21, and Ootsa Lake, August 2. The first young was seen at Francois Lake, August 4, and this, or another, again on August 8 and August 10. At Bouchie Lake, August 19, four young came under observation a number of times. Once all stood close together on the ground in an open meadow, no doubt resting after several hours spent in hunting.

Osprey--Pandion haliaetus (Linnaeus).

The first was recorded on May 11 at Puntchesakut Lake and at least one was still there on September 2. One, or a pair, were observed also at Puntataenkut Creek, May 16; Puntataenkut Lake, June 4; Bouchie Lake, June 6; Dragon Lake, June 9; Summit Lake, June 26; Nukko Lake, July 4; Chief Lake, July 7; Seymour Lake, July 15; Bulkley Lake, July 28; Shafer Lake, August 5.

At Puntataenkut Lake one standing near the top of a tall dead spruce was tearing at the trunk of a trout about 10 inches long. The forward part of the fish was held across a slim branch so that the most of its length hung downward. When a boat was rowed close to the tree the osprey flew off carrying the trout.

Pigeon Hawk--Falco columbarius Linnaeus.

Sight records of light-coloured pigeon hawks are: adult male, near Ten Mile Lake, north of Quesnel, June 23; adult male, Francois Lake, August 10; young male, Sixteen Mile Lake, August 28. There are three records of individuals much darker in colouration. At Hazelton, June 25, a male carrying a small bird in its claws flew directly overhead pursued by five or six violet-green swallows. It flew in a straight course across the river and finally passed out of sight over the forest on the other side. At Francois Lake a young, dark-coloured female standing on top of a fence post was examined through 6X binoculars. A young female collected at Shafer Lake, August 7, was standing on the top of a tall, dead spruce close to the shore. This specimen is typical of the race F. c. sucklei Ridgway. In its stomach were fragments of 20± grasshoppers and the remains of one adult dragonfly.

Sparrow Hawk--Falco sparverius Linnaeus.

Scarce in Baker Creek Valley where only two were seen during the month spent there. It was seen more often in the open country north of Prince George and in the Bulkley Valley between Smithers and Telkwa. A pair that frequented several old dead cottonwoods near the latter place, and were accompanied by full grown young, probably nested in one of the trees which had several old woodpecker holes in the trunk.

What may have been an early migration involving some 20 adults and young was observed between Telkwa and Topley on July 26. Others, apparently transients, were recorded at Francois Lake during the second week of August.

Blue Grouse--Dendragopus obscurus Say.

On July 20 and July 21 a few blue grouse, including two females with broods of small young and at least one old male, were seen on alplands above Red Rose Basin in the Rocher Deboule Mountains. The females and young frequented open slopes amongst the heather, the male, or males, dense thickets of procumbent fir. At Francois Lake, August 15, a female and brood of at least four nearly full grown young were observed on a rocky, brush-covered slope just above the lake. Blue grouse are reported from various mountains adjacent to the Bulkley Valley, but these were the only ones seen.

Three specimens collected, viz.; an old, adult male, Rocher Deboule, July 21, a young male and a young female, Francois Lake, August 15, are considered to be ultra-typical examples of the dark subspecies Dendragopus obscurus richardsonii Douglas.

Franklin Grouse--Canachites franklini (Douglas).

Several females were flushed in the Baker Creek Valley region in May and on May 10, Mr. Carl Quanstrom found a nest with nine eggs about five miles north of Puntchesakut Lake. He described the site as being beside a fallen tree in open lodgepole pine forest. The female flushed as he rode by.

In the region north of Prince George it was more plentiful. At Summit Lake during the last week of June a female and brood of 10 young, about one-fifth grown on June 27, frequented a brushy clearing and roadway. The female was exceptionally tame--even for this characteristically unsuspicious grouse--and permitted me to take a series of photographs while I stood at a distance of 10 feet or less (Fig. 37). On one occasion when I disturbed the family in the clearing the female remained on the ground until all the young had flown into nearby trees and not till then did she rise

Other females, probably all with broods although the young were not seen in every instance, were noted near Prince George, at Nukko Lake, Chief Lake, near Houston and, later in the summer, at Sixteen Mile Lake. These showed lack of concern in varying degree--one that flew from the ground to a nearby stump allowed an approach within 12 feet (Fig 38). Two of the three adult males which came under observation were less confiding. The third, flushed at Summit Lake, June 27, alighted 10 feet above the ground in an alder and when I stood directly beneath his perch he merely moved his head from side to side and shifted about on the branch

At Sixteen Mile Lake in the latter part of August, two broods, one of seven, the other of eight nearly full grown birds, came under daily observation. Never before have I seen individuals of this species so completely unconcerned in the presence of man. They went about their various activities while I stood in full view only a few feet from them. One picked up gravel on a roadside, actually at my feet; at the same time another member of this brood crossed the road and almost brushed my shoe in passing. Another took a dust bath in a shaded spot on a sunny hillside while I focused a camera on it at about four feet. Several members of another brood picked blueberries from the bushes; others perched nearby on the lower branches of a spruce thicket while I stood amongst them. A soft, cooing note was given constantly whether by adult female or by both female and young was not determined.

Reports received from local residents are to the effect that 'fool hens' had been scarce in the autumn of 1943. The fact that broods contained as many as seven and eight birds so late as the last week in August (1944) would seem to evince that progress to a higher population level is under way

Ruffed Grouse--Bonasa umbellus (Linnaeus).

Found to be very scarce in the Baker Creek Valley where during the month of May not more than four were seen, or heard drumming, in the course of one day's walk that designedly passed through what good grouse territory was sighted In September, on much the same territory, only two were flushed during parts of three days spent in the woods

The only precise evidence of predation encountered during the summer was on May 24 near "Goose Lake" where a male had quite recently been eaten on the ground beside a trail through lodgepole pine woods.

Nothing was left except feathers, the crop and a few of the smaller bones. This was attributed to coyote predation.

A scarcity of ruffed grouse seemed to be general in the regions visited. However, at Francois Lake an apparent exception was observed. None was met with during four days in which much good grouse cover had been travelled through, but on August 9 a large covey--what might have been the entire population from a considerable tract of territory--was encountered under somewhat unusual circumstances. I was working through a thick willow bottom, where the trees averaged 30 feet in height and made a dusky shade, when a large number of grouse rose simultaneously with a loud and continuous explosion of wings that lasted for several seconds. In the denseness of the thicket none was seen but as I walked further others were momentarily sighted, some rising from the ground others bursting out from thick foliaged trees. Finally eight or more were detected high up in the willows and these remained on their perches, craning their necks from side to side, while I passed underneath them. An exact count of the covey was not possible under these conditions but it was estimated to number at least 30 and probably close to 40. At any rate it was the largest covey I have ever encountered at any place.

Two young birds that were collected had eaten grasshoppers as the chief item; lepidoptera larvae and unidentified leaves were present in smaller amounts.

So large a number of birds together so early in the season--some were less than half grown--and the fact that after feeding they roosted together above the ground suggests the following conclusions: first, all the local population were attracted to this section by an abundance of grasshoppers; second, a continued association of broods afforded some protection against predation by coyotes and wolves both of which were active in the neighborhood.

According to verbal reports made by hunters ruffed grouse were abundant in the autumn of 1942 and exceedinly scarce in the autumn of 1943. Apparently a sudden decline in numbers was uniform over a large section of country at least from Quesnel west to Nazko, north to the Salmon River and northwest to Hazelton. In the Quesnel district, the scarcity was so apparent that a sportsmen's organization recommended a closed season for hunting. This was put into effect for 1944 in respect of the Cariboo and Lillooet provincial electoral districts. The greater part of the closed area lies south of the region under review.

Information as to periodicity in numbers in earlier years is available only in respect of the Cariboo Parklands where personal observations have been made since 1931. In this section the last peak of abundance was in 1932, and 1933 was a year of scarcity. Subsequently some recovery took place but a relatively low population level was general during the following 10 years--the normal time period of the grouse cycle from peak to peak. Some fluctuations in numbers were observed but no general and cumulative increase occurred. Thus in 1942--the peak year in districts farther north--the population was not conspicuously larger than it had been five years earlier. This was so, at least, in the areas which are persistently hunted; conditions in remote sections may have been more favourable.

Willow Ptarmigan--Lagopus lagopus (Linnaeus).

Residents of the Ootsa Lake settlement informed me that ptarmigan with black tails nested on the plateaux south of Ootsa Lake and visited the valleys in winter. The species is known to nest on Nine Mile Mountain near Hazelton.

White-tailed Ptarmigan--Lagopus leucurus (Richardson).

An adult female and one of a brood of six large young were collected on Rocher Deboule, July 21 and July 22 respectively. Visitors to that area reported seeing larger numbers earlier in the summer. It is said to be common there in winter also.

According to report this ptarmigan nests on the mountains south of Ootsa Lake, visits the valleys during the stormy weather in winter and retreats to higher slopes when the weather clears.

Mr. Quanstrom told me that flocks used to frequent Baker Creek Valley in winter but none had been seen there since 1937. Reported also in winter from Bouchie Lake, Francois Lake, Bulkley Lake and Smithers. The latter record is supported by two specimens, taken a number of years ago, in the possession of Mr. J. B. Langston.

Sharp-tailed Grouse--Pedioecetes phasianellus (Linnaeus).

Reported from the west side of the Fraser River near Alexandria, from the Quesnel and Baker Creek Valley regions, from Strathnaver on the east side of the Fraser River 30 miles north of Quesnel and from other localities west at least as far as Vanderhoof. At Puntchesakut Lake it is said to frequent the flats covered with dwarf birch--

known locally as buck brush--and to feed on the buds of this shrub. As none was seen anywhere during the summer it can be concluded that the species is now scarce. A report of an abundance in the Vanderhoof district was not investigated.

Sharp-tailed grouse were once plentiful in many parts of the interior of British Columbia; as the country became settled its history has been one of gradual decline in all localities and virtual disappearance in some.

Ring-necked Pheasant--Phasianus colchicus Gmelin.

Introduced near Quesnel and at Smithers a number of years ago. Some reproduction took place and at Smithers a few were seen until 1935 approximately. Apparently none has survived.

Lesser Sandhill Crane--Grus canadensis (Linnaeus).

Accounts of sandhill cranes passing over various points between Prince George and Smithers have been received, none so precise as that furnished by Mr. J. Sugden, Francois Lake. In a personal communication he states that in the spring of 1943 the first, a flock of 155, was recorded on April 14 and others were counted as follows: April 24, 386; April 25, 148; April 26, 36. On the night of April 26 another flight was heard passing over. Autumn migration dates for Francois Lake are: October 2, 1943, 12; October 7, 1943, 107. In 1944 Mr. Sugden heard night flights on October 26, 28, and 30, and counted one flock of 130+ during daytime on October 28. Settlers on Bulkley Lake told me that large flocks visited the fields there in spring.

Presumably these large flocks are composed exclusively of lesser sandhill crane.

Greater Sandhill Crane--Grus mexicanus Müller.

Sandhill cranes nest on the muskegs both east and west of Quesnel and for an undetermined distance north but apparently not to the latitude of Prince George. A number of trappers and other persons, familiar with the country north of the Canadian National Railway, who were questioned on the subject told me that no cranes nested in the districts with which they were familiar. It is a matter of some difficulty to locate a sandhill crane's nest, nevertheless their presence in summer, usually made apparent by voice and behaviour, is unlikely to escape notice. Therefore an answer in the negative to this enquiry may be considered information of value. If it is correct, and it would seem to be so, that the species does not nest as far north as the latitude of Prince George then there is a very considerable gap of unoccupied territory between the nesting grounds of this species and those of the lesser sandhill crane.

In the Baker Creek Valley during May one occasionally was seen or heard in flight, and on May 20 a nest containing two eggs was found on a muskeg about three miles north of Puntchesakut Lake, where a pair had been located a week earlier. This is a large muskeg separated into two sections by a high forested island. The portion frequented by the cranes was fairly dry and contained no cover other than scattered dwarf birch. Along the edge this growth is more plentiful and interspersed with small dwarf spruce (Fig. 2). Just before I reached the edge of the muskeg the female crane rose from somewhere in this section and, after flying a short way, alighted again close to the edge; through this cover her cinnamon-coloured back was visible as she moved from place to place. Once when she came into the open it could be seen that she walked with long strides--her neck swaying from side to side--and how brilliant became the bare crimson skin of her face when the sunlight caught it. An attempt to obtain a photograph at close range was not successful. She rose some 300 yards away and flew down the muskeg (Fig. 39). Later the male joined her and both were heard calling.

The nest consisted of a flat platform 18 inches in widest diameter, made of dead dwarf birch twigs and a small amount of grass (Fig. 40).

Virginia Rail--Rallus limicola Vieillot

At Maclure Lake, July 15, the familiar call of this rail was heard in three different parts of the shoreline marsh. None was seen here or elsewhere in the region. It is regrettable that a record extending the species' known limit of range a considerable distance northward is not supported by the evidence of a specimen collected.

Sora--Porzana carolina (Linnaeus)

Recorded, on the basis of voice only, at two localities, viz.; Puntataenkut Creek, May 16, May 31, and at two places on Dragon Lake, June 9.

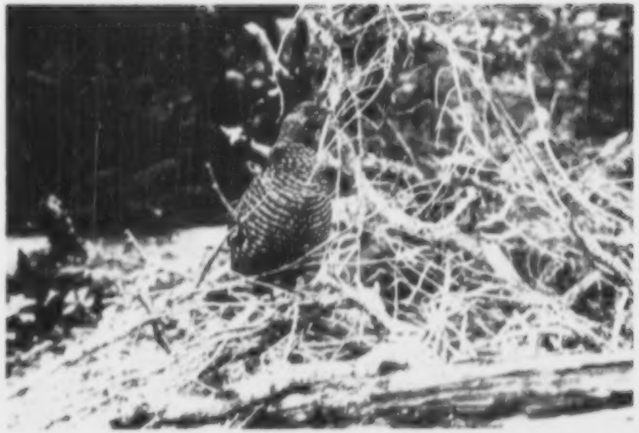


Fig. 38. Franklin's Grouse, near Nukko Lake.

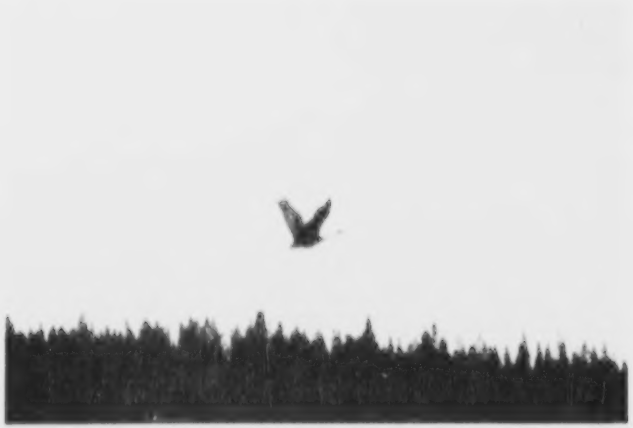


Fig. 39. Greater sandhill crane flying over muskeg, Puntachesakut Lake.

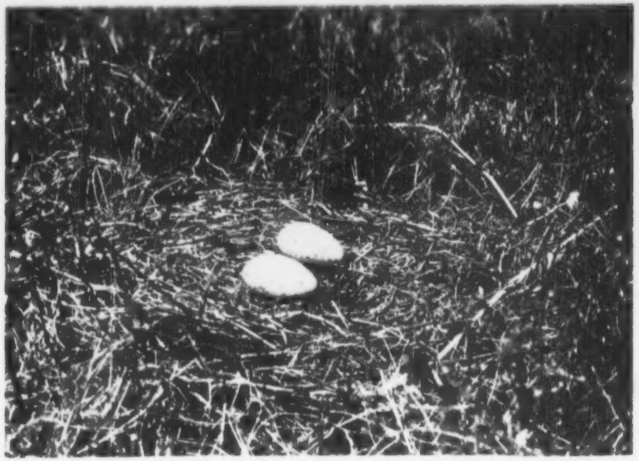


Fig. 40. Nest and eggs of Greater Sandhill Crane on muskeg, Puntchesakut Lake.

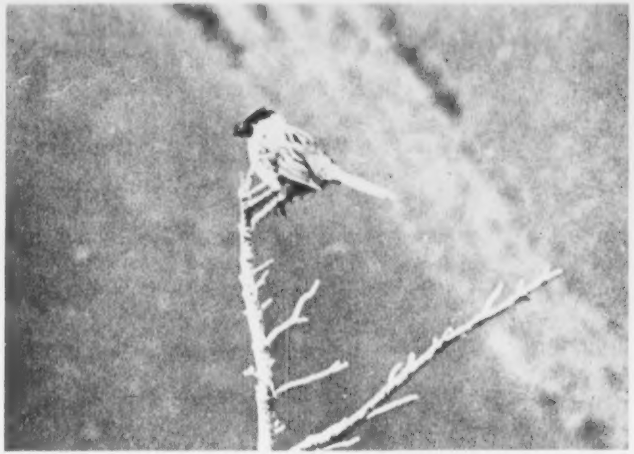


Fig. 41. Gold-crowned sparrow with food in bill. Rocher Deboule.

American Coot--Fulica americana Gmelin.

Scarce even in the most southern of the localities visited. Thus on Puntataenkut Creek, where nesting cover is restricted to sedge marsh, 10 adults were observed on May 16 and again on May 31. At Dragon Lake, where there is much round-stem bulrush cover suited to the specie's nesting requirements, the observed population on June 9 consisted of one adult with eight downy young, and two other adults. On Dale Lake, June 20, one adult with six small young, and three other adults were observed. One adult and three young about one-third grown, on a cattail-fringed pond near Prince George, July 10; one adult seen and another heard at Maclure Lake, July 15, are the only records for more northern districts. It is reported from Nukko Lake and from Chief Lake but I found none there.

Semipalmated Plover--Charadrius hiaticula Linnaeus

One male, a bird of the year, collected on a small sandy beach at the mouth of Maxan Creek, Bulkley Lake, July 28, is the only record

Killdeer--Charadrius vociferus Linnaeus.

Much less common than in southern British Columbia; none was seen in the Baker Creek Valley but it is reported by residents to nest there. Adults under observation at Dragon Lake, June 9, at Bouchie Lake, June 17 and at Dale Lake, June 20, acted in the manner characteristic of parents with small young. Two full grown young that frequented a gravel bar in the Bulkley River near Bulkley Lake during the last week in July undoubtedly had been raised there. The first transients were recorded at the mouth of Maxan Creek, one on July 27 and five on July 31.

Wilson Snipe--Capella gallinago (Linnaeus).

One was flushed from a small patch of sedges at Tiltzarone Lake, May 7, and another from a sedge meadow at Puntchesakut Lake on May 10. At Goose Lake, May 14, individuals observed in display flight and heard bleating were considered to represent two nesting pairs. One was flushed from the mouth of Maxan Creek, Bulkley Lake, July 27 and this bird, or another, was seen again on July 30 and July 31. These are the only records.

Spotted Sandpiper--Actitis macularia (Linnaeus).

Found to be rather widely distributed and a relatively common summer visitant, the first being recorded at Puntchesakut Lake on May 14. It was observed also at Chief Lake, July 6; Nukko Lake, July 7; Hazelton, July 25; Bulkley Lake, July 27 and at Francois Lake. At the latter place on August 12 approximately 10 were observed on a number of small beaches between Francois Lake settlement and a point 20 miles to the west.

Solitary Sandpiper--Tringa solitaria Wilson.

None was seen during the nesting season. A transient at Nukko Lake, July 7, another near Ootsa Lake, August 2, are the records of observations.

Greater Yellowlegs--Totanus melanoleucus (Gmelin).

In early May two, or perhaps three, pairs attempted to nest on or near a sedge meadow that extends from Puntchesakut Lake to Tiltzarone Lake. Here and in the vicinity one or more frequently were heard, or seen in display flight, or standing on muskrat houses. Several were caught in traps set by a local trapper for muskrats--apparently this is of common occurrence. Two of these, both females, became available for examination; one taken May 5 contained eggs in an advanced stage, another taken May 13 held an egg in the oviduct which was complete and intact except for one small perforation. Whether or not any of this population succeeded in nesting was not determined. Two other pair probably nested in the vicinity, one at "Goose Lake" the other near an adjacent forest pond. A pair also was observed at Dale Lake on June 20.

At Summit Lake, June 27, an adult that undoubtedly had young was very demonstrative on a muskeg, circling about overhead, alighting on the spruces and whistling continuously. On the following day another, perhaps the female of this pair, when flushed from this muskeg was silent and made no demonstration.

One pair, at least, nested at Nukko Lake and on July 4 an adult accompanied by one small young was seen on a muddy beach.

Another pair at Swamp Lake was still together on July 5. One of them behaved in the familiar, excited manner of a solicitous parent, the other was silent. None was recorded west of the Nukko Lake region.

Lesser Yellowlegs--Totanus flavipes (Gmelin).

Two young on the southern migration were recorded at Bulkley Lake, July 28, July 30, and at Shafer Lake a flock of seven young was seen on August 7.

Pectoral Sandpiper--Erolia melanotos (Vieillot).

At Goose Lake, May 24, a flock of 15 was observed several times in rapid, wheeling flight over this grassy slough. Two autumn transients were flushed at Bulkley Lake, July 31.

Baird Sandpiper--Erolia bairdi (Coues).

Four adults were seen at close range on a muddy beach of Toboggan Lake, July 13. Undoubtedly these were autumn transients.

Least Sandpiper--Erolia minutilla (Vieillot).

Autumn transients were recorded as follows: Bulkley Lake, July 27, 2; July 28, 2; July 31, 4; Francois Lake, August 4, one in company with three semipalmated sandpipers.

Dowitcher--Limnodromus griseus (Gmelin).

At Lacroix Lake, July 14, an adult in summer plumage was examined through 6X binoculars at a distance of approximately 30 yards. None was seen elsewhere.

Semipalmated Sandpiper--Ereunetes pusillus (Linnaeus).

At Nukko Creek, July 7, a flock of eight adults in worn breeding plumage was feeding on a muddy beach. One of these was collected. Records of young on migration are: Bulkley Lake, July 29, 1; July 30, 8; July 31, 8; Francois Lake, August 7, 3; Shafer Lake, August 12, 2. All these birds were examined very closely through binoculars in order to determine if any were the relatively long-billed western sandpiper but none was so identified

Wilson Phalarope--Steganopus tricolor Vieillot.

At Dale Lake, June 20, a male circled about a small area of short grass making the familiar soft alarm note that indicates the presence of young. After some search two downy young, a day or so old, were caught and photographed. At Nukko Creek, July 7, three adult females, probably transients, that walked about on the lily pads, were under close observation for ten minutes or longer. These records mark a considerable northward extension of the range of this species in British Columbia.

Northern Phalarope--Lobipes lobatus (Linnaeus).

A flock of seven on Puntchesakut Lake, September 3, is the only record.

Herring Gull--Larus argentatus Pontoppidan.

An observer at Puntchesakut Lake told me that gulls arrived there about the time the ice was out of the lake in late April. Probably these were herring gulls This species was seen there almost daily during May and up to the time I left the region on June 5 All except two of these were adults. None nested there although a male and female that loafed on a stony point several days in succession were evidently paired. Eight was the largest number counted in one day and mostly these associated with a flock of diving ducks and grebe on the centre of the lake One or two made frequent excursions along the shore and several attended the fishing operations of American mergansers on at least two of the occasions when these ducks visited the lake.

At Bouchie Lake a pair was seen daily between June 5 and June 17, their favourite resting place being a log boom anchored to the shore; here they remained for hours at a time. They made daily flights around the circumference of the lake and apparently consumed some of the dead suckers that floated about on the lake to finally become anchored in the marshes or drift on to the beaches. There was no reason to conclude that the pair nested on or near Bouchie Lake, although a young bird in fresh juvenal plumage was seen there on August 19

Two adults were recorded at Summit Lake, July 1, and single adults at Seymour Lake, July 13; Lacroix Lake, July 14, Maclure Lake, July 15 and Hazelton, July 25 Four were seen flying high over the woods near Topley on July 26, and a second or third year bird was recorded at Bulkley Lake on July 27.

There is a nesting colony on a rocky island south of Wright's Bay opposite Topley Landing on Babine Lake. This statement is based on information received from several persons who have visited the locality, one being Game Warden Muirhead who examined old nests there after the nesting season.

A small number nest each year on a large rock in Ootsa Lake, about eight miles west of Ootsa Post Office. Adults were seen flying over this rock on August 2, and Mr C. McNeil told me of seeing young gulls standing on the rock when he passed it by boat on August 1 There is another colony on an island in Whitesail Lake. I have examined a photograph of downy young, apparently herring gull, taken there several years ago by W. McNeil

Ring-billed Gull--Larus delawarensis Ord.

The only record is that of a female collected on Puntchesakut Lake, May 27. This specimen is in the second nuptial plumage as described by Dwight (2). The head is white, the mantle gray; on one the first primary is a small mirror, on the other a trace of white; the tail has a dusky terminal band; both wings and tail are abraded. Bill cadmium with sub-terminal dusky blotch and pale vermilion patch on lower mandible; iris light brown, edge of eyelids and gape bright vermilion. The ovarian mass measured 20 mm. by 12 mm. When picked up this bird disgorged a portion of the trunk of a Rocky Mountain whitefish that would when intact have measured about seven inches in length.

Short-billed Gull--Larus canus Linnaeus.

Small numbers visited Puntchesakut Lake during the spring migration and, like the herring gull, associated with diving ducks and grebes on the centre of the lake. However, these little gulls were quite fearless and I sometimes paddled close to them. The dates seen and numbers counted are: May 6, 10; May 7 (a.m.), 4, (p.m.) 24; May 11, (noon) 7, (4:30 p.m.) 24. The flock of 24 left the lake that evening and none was subsequently seen there.

The only other record is for an adult at Seymour Lake, July 13. This bird was standing on a 'dead head' near the centre of the lake and I paddled within a few yards before it flew.

Bonaparte Gull--Larus philadelphia (Ord).

A flock of 50± at Dragon Lake, May 6, a single bird at Tiltzarone Lake, May 17, another at Puntchesakut Lake, May 24, and a flock flying over the same lake on the night of May 29, were considered to be transients.

At Swamp Lake, July 5, two pairs observed in flight, and a flock of eight seen mobbing a bald eagle, were thought to represent the total of a nesting population at that place. Because of various difficulties it was not practicable to conduct a search for nest at that time. However, Mr. Frank Allen, who lives not far from the lake, told me that the gulls were there each summer. He said also that at times, when walking along the shore, the gulls had swooped down at him from spruce trees where they probably had nests. In May, 1944, Game Warden Muirhead had a similar experience beside a pond near Burbidge Lake which is 20 miles east of Telkwa. This would indicate nesting at that place.

Other summer records are: four adults at Seymour Lake, July 13; four adults at Maclure Lake, July 15; two adults and eight flying young seen several times, both in flight and on the water, at Shafer Lake between August 5 and August 9. Two of the four at Maclure Lake, identified as adults, had white heads--either because of an early moult, or because the plumage of the previous winter had been retained. Instances of the latter condition have been observed in May. These four birds cruised along shore and were watched at close range a number of times.

Black Tern--Chlidonias nigra (Linnaeus).

The first black terns were recorded on May 23 when four appeared flying over Puntchesakut Lake; others were observed in the Baker Creek Valley as follows: Goose Lake, May 24, 2; Puntchesakut Lake, May 29, 2; May 30, 2; June 4, 1; Puntataenkut Creek, May 31, 10; Puntataenkut Lake, June 4, 3. Those at Puntataenkut Creek were circling lower over a sedge marsh in the manner of nesting birds

At Dale Lake on June 20 three were observed flying about the meadow and these also may have been nesting

A nesting colony of 20 to 30 pairs on the deep bog at Nukko Creek was under observation on July 7 Some carrying food in their bills hovered for a few moments then dropped out of sight amongst the marsh growth; others wheeled about overhead, and sometimes swooped down with a few feet of me as nesting black terns commonly do.

Other summer records are: Bouchie Lake, June 12, 2; Summit Lake, June 28, 2; July 3 - 2; Nukko Lake, July 8 - 2 So far as I am aware the species has not hitherto been recorded from central British Columbia.

Horned Owl--Bubo virginianus (Gmelin).

Two that were heard on several nights in early May beside Puntchesakut Lake hooted in the manner of paired birds, i.e., one hooted and was quickly answered by the other It was thought likely these were hunting food for young in the nest. A large pellet found on the lakeshore and probably cast by a horned owl was composed chiefly of grebe feathers and bird bones presumably also of grebe

Another pair of horned owls that was heard several times during the evening dusk at Nukko Lake answered each other with a deep, resonant hooting Heard at close quarters it was an explosive sound produced with great vigour and at shorter intervals than ordinary. Reference was made earlier to a horned owl attacking a brood of baldpate as it swam along a narrow backwater of the Bulkley River. Supplementing this account it can be added that after the unsuccessful attempt to seize one of the baldpate the owl continued to hunt, crossing from one side to the other of the narrow opening through the forest that marked the course of the slough or backwater At the same time two others, full grown young, flew silently from one tall cottonwood to another. Both called repeatedly--the voice not unlike the cry of a nighthawk but with more volume. During this time two or more broods of mallards had run into cover but the mothers remained on the slough and were heard flying from place to place and quacking vigorously. A female green-winged teal behaved in a similar manner; so, as has been said, did the female baldpate; two robins made constant outcry.

A horned owl at Sixteen Mile Lake, August 27, probably was a transient. In dark woods this bird appeared suddenly and silently, in response to a squeak, and alighted in a lodgepole pine about 30 feet from where I stood.

A resident at Bouchie Lake told me of shooting 11 horned owls in the autumn of 1943. This, together with other less precise statements regarding numbers seen in that general region, indicate that more than the usual migratory movement took place in that year.

Snowy Owl, *Nyctea scandiaca* (Linnaeus).

Reported to be a more or less regular winter visitant to the Quesnel region. There is a mounted specimen in a hotel at Quesnel, which was shot near that place. Mr. J. Sugden in a personal communication states that more than the usual number of "arctic owls" visited the Francois Lake region during the winter of 1942-43.

American Hawk Owl--*Surnia ulula* (Linnaeus).

There are three mounted specimens, shot near Smithers during winter, in the collection of J. B. Langston.

Great Grey Owl--*Strix nebulosa* (Forster)

There is a mounted specimen in a hotel at Quesnel that is said to have been shot locally. Another mounted specimen, until recently in the office of the Provincial Game Department at Quesnel, was shot near Barkerville in the year 1940.

Little Boreal Owl--Cryptoglaux funerea (Linnaeus).

Mr. J. B. Langston has one mounted specimen; this bird was found dead in winter near Smithers.

Saw-whet Owl--Cryptoglaux acadica (Gmelin).

At Puntchesakut Lake in the evening of May 13 the single, bell-like note of the saw-whet owl was heard and when I drew the attention of a local guide to this call he informed me it was a familiar sound in that region. There are two mounted specimens in Mr. J. B. Langston's collection. These were found dead near Smithers.

Nighthawk--Chordeiles minor (Forster).

The first was recorded at mid-day, June 6, flying over Bouchie Lake where the species became common on June 10. Through July nighthawks were seen at most of the places visited; the first evidence of a southern migration was noted on August 9. This was at Shafer Lake in late evening when approximately 20 flew about over the lake. Again at Bouchie Lake, after a morning of rain on August 17, a migration was observed.

Black Swift--Nephoecetes niger (Gmelin).

Two were observed several times on July 14 flying over Lacroix Lake. It has been noted many times that black swifts are more active, apparently more numerous, and fly closer to the earth, on rainy and stormy days than on fair days. This was so at Maclure Lake on July 14, a day of intermittent showers and cloudy skies. There are sheer cliffs, where black swifts could find nesting places, in the not far distant mountains on either side of the Bulkley Valley.

At Ootsa Lake, August 3, at least eight were seen and at Bouchie Lake, August 17, what appeared to be a migration involving a substantial number of black swifts, vaux swifts and nighthawks, was in progress.

Vaux Swift--Chaetura vauxi (Townsend).

At Seeley Lake, July 24, five Vaux Swifts were active over the lake and several of them flew over or close to me, a number of times passing within 30 feet. An undetermined number on migration were seen at Bouchie Lake, August 17. It was not recorded elsewhere.

Rufous Hummingbird--Selasphorus rufus (Gmelin).

First recorded at Quesnel on May 5 and at Puntchesakut Lake on May 17. It was abundant at Bouchie Lake in a willow thicket near the lakeshore where on June 6 at least five pairs had nesting territories. These woods were visited many times and it was observed that the males habitually perched near the top of one or another of the many dead willows along the margin of the woods. Very likely each tree so used was within a definite nesting territory. Perched thus in the open the males were conspicuous, particularly so when, viewed at a certain angle, sunshine lighted up their crimson gorgets.

Calliope Hummingbird--Stellula calliope (Gould)

Several recorded at Puntchesakut, the first on May 25. On one occasion a male hovered momentarily in front of a cluster of black twin-berry blossoms, dashed away, then returned to the same or to another bloom on the same bush.

Belted Kingfisher--Megaceryle alcyon (Linnaeus).

First noted at Puntchesakut Lake, May 7, and observed subsequently at most of the lakes visited west to Bulkley Lake. It was more than usually plentiful at Lacroix Lake and Maclure Lake were lake shiners seem particularly abundant. At Lacroix Lake 12±, probably including several broods of full grown young, were counted.

Yellow-shafted Flicker—Colaptes auratus (Linnaeus).

A pair of flickers, yellow on the undersurface of wings and tail, nested in a tall stub near the shore of Chief Lake and were seen there on July 7. A good view of another similarly coloured was obtained at Bouchie Lake, June 12, and of two other single birds alongside the road from Prince George to Nukko Lake on July 10. No specimens were taken and it could be that some or all of those seen were auratus x cafer hybrids.

Red-shafted Flicker--Colaptes cafer (Gmelin).

The first was seen at Puntchesakut Lake, May 6. It was not plentiful in any of the places visited, moreover all were uncommonly wild and seen sometimes at such distances and under circumstances which precluded specific identification. That is to say, some might have been either Colaptes auratus, Colaptes cafer, or hybrids between the two. The largest number recorded in one day was five at Tiltzarone Lake, August 31. These flew from tree to tree along the lakeshore and obviously were migrating. No specimens were collected.

Pileated Woodpecker--Ceophlosus pileatus (Linnaeus).

One was heard or seen a number of times at Puntchesakut Lake; a pair at Bouchie Lake were evidently nesting and one was heard at Sixteen Mile Lake. These are the only personal records but from the accounts of observers in several different localities it can be assumed that the species is widely distributed in central British Columbia.

Red-breasted Sapsucker--Sphyrapicus ruber (Gmelin).

Not common but the only sapsucker represented in all of the regions investigated. The first was recorded at Puntchesakut Lake, May 8, and later others were seen in the same locality. Here it occupied open lodgepole pine woods. It does not show preference for aspen woods as does the species Sphyrapicus varius in the Cariboo Parklands to the south.

At Bouchie Lake one pair occupied the willow woods, that has been referred to several times in this paper, and here a male was incubating eggs on June 8. At another place beside this lake, on June 18, a male was watched carrying food to young and removing faecal sacs from the nest. The nest entrance, that measured one and a half inches, was 30 feet from the ground on the north side of a 10 inch aspen. At other times during my stay at Bouchie Lake this male frequently came into view as it searched tree trunks for food or flew out after some passing insect.

Several pairs observed at Bulkley Lake had nested and raised young in willow woods, and at least one brood in the flying stage was seen there on July 27.

The migration route travelled by this species to and from these regions can only be conjectured. It is not through southern British Columbia where the species is unknown, so presumably it is along the coast west of the mountains, then east and south (in spring) to central British Columbia.

Three adult specimens taken show no indication of intergradation with Sphyrapicus varius. The last is the only sapsucker represented in the Cariboo Parklands. Where, or if, the ranges of the two forms meet has apparently not yet been determined.

The supspecies represented is Sphyrapicus ruber notkensis (Suckow).

Hairy Woodpecker--Dryobates villosus (Linnaeus)

Uncommonly scarce even in recent burns--generally one of the favourite haunts of this species. It was conspicuously absent from the Puntchesakut Region where, it was expected, the large areas of aspen forest would attract nesting pairs. It was seen once near Bouchie Lake, and once at a place 10 miles south of Quesnel. In a recent burn at Chief Lake a male and female, evidently a pair, were watched for some time as they worked over the dead timber. The nest was not located. A male with brood patch was collected in deep coniferous woods at Summit Lake, June 25, and an adult, freshly moulted female at Bulkley Lake on July 28. These are examples of the sub-species Dryobates villosus monticola Anthony.

Downy Woodpecker--Dryobates pubescens (Linnaeus).

Not common A male was seen, and heard tapping out a long tattoo, near the top of a tall, dead aspen at Puntchesakut Lake, June 3; a brood of three full grown young and one of the parents came under observation in aspen woods at Bulkley Lake, June 28, and a single juvenal was seen at Shafer Lake, August 7. The subspecies represented is Dryobates pubescens leucurus (Hartlaub).

American Three-toed Woodpecker--Picoides tridactylus (Linnaeus).

An adult male with brood patch, collected, and another one seen at Sixteen Mile Lake, August 24

The subspecies represented is Picoides tridactylus fasciatus Baird

Eastern Kingbird--Tyrannus tyrannus (Linnaeus).

Not common. The first was recorded at Bouchie Lake, June 5, and later two pair, that frequented several tall aspens and the brushy margin of an open meadow at that place, were seen almost daily during my stay there It was assumed these were nesting or about to nest It was seen nowhere else during mid-summer, but at Tiltzarone Lake on August 31 two were identified at close range, once at about 20 feet, as one bird flew past me. When not in flight each perched on the tip of one of several slim, dead pines which stood above thick cover of dwarf birch near the lake It seems necessary to mention these particulars, which serve to substantiate this identification, because the date is thought to be unusually late for kingbirds. The birds undoubtedly were transients. Mr C D Muirhead in a personal letter reports seeing five on August 15, 1944, at the Dominion Government Experimental Farm five miles east of Smithers, and remarks that these were the first he had seen in the district

Alder Flycatcher--Empidonax traillii Audubon.

Recorded first June 6, at Bouchie Lake, on the basis of voice and of sight observation. The following day four were counted and in the week that followed it was determined that three pairs occupied nesting territories in one area of willow woods near the lakeshore. This was the only small flycatcher observed in that particular type of habitat at Bouchie Lake.

During July the species was recorded at Summit Lake, Bulkley Lake, Shafer Lake, and at Francois Lake young were migrating on August 4. At Tiltzarone Lake, August 31, one drove a kingbird from its perch on top of a small dead pine, pursued it for 100 yards or so, then occupied the vacated perch.

Hammond Flycatcher--Empidonax hammondii (Xantus).

First observed on May 8 at Puntchesakut Lake and subsequently as follows: Bouchie Lake, June 5; Summit Lake, June 27; Rocher Deboule at timber line, July 21; Bulkley Lake, July 27.

Wright Flycatcher--Empidonax wrightii Baird..

A small flycatcher seen at several places in Baker Creek Valley during May was identified as wrightii. A bird of the year was collected at Francois Lake, August 9.

Western Wood Peewee--Miochanes richardsoni (Swainson).

Fairly common and widely distributed. First seen May 11 at Puntchesakut Lake. Recorded also at Quesnel, June 8; Chief Lake, July 8; Seymour Lake, July 13--a nest with young 20 feet from the ground in a dead willow; Bulkley Lake, July 29; Francois Lake, on migration, August 13.

Olive-sided Flycatcher--Nuttallornis mesoleucus (Swainson).

First recorded, June 4, at Tiltzarone Lake and subsequently as follows: Quesnel, 10 miles southeast, June 20; Bouchie Lake, June 21, August 19; Summit Lake, June 26; Nukko Lake, July 7; Chief Lake, July 8; Seymour Lake, July 13; Topley, July 26; Francois Lake, August 15.

Violet-green Swallow--Tachycineta thalassina (Swainson).

Recorded first at Bouchie Lake, June 27, when at least 20 were seen with other swallows flying low over the water. Several of these flew past me a number of times within a few yards. Recorded also at Endako where on the evening of July 10 a few rested on telegraph wires. At Smithers it was common and occupied bird houses; it was nesting also in the village of Hazelton.

Tree Swallow--Iridoprocne bicolor (Vieillot).

Present in some localities and apparently absent from others. It was noted as common and apparently nesting in Quesnel village, May 5. Large numbers believed to be on migration were circling over Quanstrom Lake and Tiltzarone Lake on May 7, evidently attracted there by a recent hatch of midges. Later it was scarce in that region and only a few pairs nested there. Thus at Puntataenkut Lake where there are a number of suitable nesting trees only one pair was found on June 4. Five transients were recorded at Puntchesakut Lake on September 3. Several pairs nested at Bouchie Lake, and two pair nested about the buildings in a small clearing at Summit Lake. No other species of swallow was seen at the last place. It was relatively common at Nukko Lake, at Chief Lake, at several places between Prince George and Vanderhoof, but none was recorded west of that general region.

Bank Swallow--Riparia riparia (Linnaeus).

Identified satisfactorily at Endako, July 10, and at Bulkley Lake on July 27, where five full grown young, probably a brood, in company with other swallows occupied a telegraph wire. A specimen in the collection of J. B. Langston, which had been found dead at Smithers, establishes a record for that locality.

Rough-winged Swallow-- Stelgidopteryx ruficollis (Vieillot).

One, a transient, seen at Puntchesakut Lake on May 11. There are no suitable nesting sites at that place but there is one, at least, at Puntchesakut Lake--a low bank above the shore. This contained several swallow excavations that may have been the work of this species, but no birds were seen there on June 4. At Bouchie Lake approximately 20 hunted insects low over the lake on the morning of June 7, a cloudy and windy day, and in the afternoon five were together in a dead bush by the shore. The only other record is for a single bird at Toboggan Lake on July 13.

Barn Swallow--Hirundo rustica (Linnaeus).

Common and nesting at most of the places visited. First seen at Tiltzarone Lake on May 17, and the last record was made at the same place on August 31. During the first week in August a population nesting on the rafters under a bridge that crosses the narrows of Burns Lake had nests with eggs and others with young ranging in age from some newly hatched to some about ready to fly. This bridge was being repaired at that time under the direction of Mr. J. Sugden who told me that when a number of nests were moved to other situations under the bridge, in order to prevent them being destroyed, the parents quickly became accustomed to the changed situation and continued feeding the young. At this time also another population under the wharf at Southbank, Francois Lake, was feeding young

Cliff Swallow--Petrochelidon pyrrhonata (Viellot).

Common and widely distributed, the first seen on May 6 at Dragon Lake. A colony of 10 pairs was nest building at Nukko Lake so late as July 4, and small nesting colonies were noted at numerous other places as far west as Hazelton

Canada Jay--Perisorsus canadensis (Linnaeus).

Observed at the following places, viz.; Puntchesakut Lake, Summit Lake, Prince George, Vanderhoof and Ootsa Lake.

Steller Jay--Cyanocitta stelleri (Gmelin).

Reports were received of the occurrence of this species in winter at Puntchesakut Lake, Bouchie Lake, Francois Lake, Whitesail Lake and Smithers None was personally observed

Magpie--Pica pica (Linnaeus).

Residents of Quesnel told me of seeing magpies occasionally during autumn and winter; a settler at Francois Lake reported seeing several, also in winter, and there is a winter record for Smithers based on two specimens taken there by M. J. B. Langston.

American Raven--Corvus corax Linnaeus.

Mr Julius Quanstrom informed me that ravens visit Baker Creek Valley in winter but have not been observed there in summer. Mr. Martin Shafer has seen ravens in winter along his trapline on the Salmon River He states that they visit the wolves' moose kills and feed upon whatever scraps have been left.

American Crow--Corvus brachyrhynchos Brehm.

Small populations present in most of the regions visited. At Puntchesakut Lake the largest number seen in one day was nine on May 30. Dead suckers thrown on to the bank of a small creek attracted them, and they visited a settler's pig pen for scraps. The aspens along the lakeshore were favoured resting places and there, hidden by the foliage, individuals were heard making the musical chuckles and cooing sounds associated with the breeding season. However they did not nest along the lakeshore but apparently did so half a mile or more away in the lodgepole pine forest. At Bouchie Lake three pairs nested in a willow thicket; one nest examined was approximately 20 feet from the ground. A settler at that place told me it is common for crows to attend the operation of haying--after the cocked hay has been pitched onto the hay wagon the crows capture, or attempt to capture, the young voles which have been hiding under the hay cocks

At Bulkley Lake in late July, adults and young in flocks were seen numerous times feeding on grasshoppers that were abundant in hay meadows. The largest flock contained 30 birds

Clark Nutcracker--Nucifraga columbiana (Wilson).

Mr C. D. Muirhead reported seeing one in Telkwa village several years ago, and there is a specimen taken at Smithers in

Mr. J. B. Langston's collection. These are the only records obtained.

Black-capped Chickadee--Parus atricapillus Linnaeus.

Fairly common in aspen woods at Puntchesakut Lake in May, and at Bouchie Lake two pairs were nesting in a willow thicket. Recorded also at Summit Lake, Chief Lake, Bulkley Lake, Ootsa Lake and Francois Lake.

Mountain Chickadee--Parus gambeli Ridgway.

Much less common than the last and identified with certainty only at Puntchesakut Lake on May 6, May 8, when a pair, evidently nesting, was observed, and on September 6 when three or more, travelling with black-capped chickadee, came within close range.

Hudsonian Chickadee--Parus hudsonicus Forster.

One specimen was collected at Puntchesakut Lake, May 18; another at Sixteen Mile Lake, August 24. At the last place small bands were met with at various places. Observed also in the spruce woods at Swamp Lake on July 5.

The subspecies represented is Parus hudsonicus columbianus (Rhoads).

Red-breasted Nuthatch--Sitta canadensis Linnaeus.

Seen or heard at Puntchesakut Lake, Bouchie Lake, Quesnel, Sixteen Mile Lake and Summit Lake.

Dipper--Cinclus mexicanus Swainson.

Probably resident on many of the mountain streams but none was personally observed. Dr G. R. Baker has seen it several times on Sixteen Mile Creek, and there are definite records of its occurrence on Morice River and on other streams in Bulkley Valley.

Winter Wren--Troglodytes hiemalis (Linnaeus).

Several were seen, and males were heard singing, numerous times on Rocher Deboule in the last heavy forest just below timber line. Undoubtedly these were nesting there. A total of 8 was observed in the woods at Sixteen Mile Lake in late August. These were assumed to be transients. This record is of particular interest because the species is not known to occur in the Cariboo Parklands some 75 miles to the south. One specimen was collected.

American Robin--Turdus migratorius Linnaeus.

Common in many types of habitat in all the region visited. Several were seen even on the alplands of Rocher Deboule and it was reported to me that a pair nested on a mine structure there, situated more than a mile from the nearest tree. At Summit Lake a female with brood of nearly full grown young, and a nest containing four large young built under the projecting roof of a log house, were observed on June 25. At Bulkley Lake and at Francois Lake robins hunted grasshoppers on the meadows where hay had recently been cut; at Puntchesakut Lake they were seen feeding on blueberries in the lodgepole pine woods. The first migration of some 25 birds was noted at Francois Lake August 8 and transients were conspicuous thereafter. The largest flock observed, 40±, was at Puntchesakut Lake on September 4. The single specimen collected, Puntchesakut Lake, September 5, is typical of the race Turdus migratorius propinquus Ridgway.

Varied Thrush--Ixoreus naevius (Gmelin)

Single individuals were heard whistling, or seen, as follows: Puntchesakut Lake, June 1; Summit Lake, June 26, June 27; Chief

Lake, June 27; Sixteen Mile Lake, August 23. In every instance the habitat was one of deep woods.

Hermit Thrush--Hylocichla guttata (Pallas).

This was one of the commoner summer visitants to Baker Creek Valley. The first was seen at Puntchesakut Lake, May 6, and on May 8 ten were found in various types of woodland habitat. Thereafter the song, first heard on May 8, became one of the most familiar sounds in the forest. Mated pairs were met with in many parts of the semi-open lodgepole pine and aspen woods; this habitat was the one most favoured.

At Milburn Lake, June 10, a male was under intermittent observation for half an hour. This bird was perched on the extreme tip of an upright dead branch that stood about five feet above the massed upper foliage of a cottonwood--just such a perch a flycatcher would choose. It sang at short intervals during all the time I was within hearing.

Hermit thrushes were heard also in the deep woods at Summit Lake in late June but there it was less plentiful than the olive-backed thrush. In the Red Rose Basin, Rocher Deboule Mountain, it was common in an entirely different type of habitat, viz.; the low alpine fir thickets near timberline.

None was observed in the lowlands at Bulkley Lake, Francois Lake, and Ootsa Lake; it was not met with again until August 25 when one was seen in the coniferous forest near Sixteen Mile Lake. When I returned to Puntchesakut Lake on August 29 all of the nesting population apparently had moved out. None was recorded until September 2 when several were observed feeding on blueberries. These were considered to be transients.

The subspecies represented is Hylocichla guttata guttata (Pallas).

Swainson Thrush--Hylochichla ustulata (Nuttall).

Recorded at Puntchesakut Lake, on the basis of song, May 16 and May 20. It was common and nesting at Bouchie Lake, where it frequented dense willow thickets. This was the common thrush in the following localities, viz.: Quesnel, where it was in full song on June 8; Dale Lake, Summit Lake, Nukko Lake, Chief Lake, Bulkley

Lake, Telkwa, and Smithers. The last was recorded at Francois Lake on August 4 None was seen at Bouchie Lake on August 17, nor subsequently, in wooded areas where it had been plentiful in June.

The subspecies represented is Hylocichla ustulata almae Oberholser.

Mountain Bluebird--Sialia currucoides (Bechstein).

The mountain bluebird is commonly restricted to open woodlands bordering grasslands, old burns and other types of semi-open habitat. Roadways through country of this sort are particularly favoured. It was found wherever these conditions prevail, along the highway between Alexandria and Quesnel, in the open country along the Fraser near Quesnel, at Chief Lake, Francois Lake, and elsewhere It was not observed in the Baker Creek Valley, in the forested country west of Quesnel, nor in places at altitudes higher than these regions.

Broods of flying young were recorded near Prince George, June 23; Chief Lake, July 5; Endako, July 10, and Smithers, July 17. Migrations of some volume were observed at Francois Lake, August 10 and south of Prince George on August 16.

Townsend Solitaire--Myadestes townsendi (Audubon).

A pair nested beside the Nazko Road near Puntchesakut Lake, the site being a deeply eroded crevice in a clay bank. The nest, made of dry grass on a foundation of spruce and aspen twigs, contained four eggs on May 21. The female was flushed from the nest a number of times up to June 1 and on that date the eggs were not hatched.

Adults, and young moulting from the spotted plumage, were observed in this general region during the first week in September. Like many other birds at this time they fed on the abundant blueberries. Elsewhere the species was recorded only on Rocher Deboule where two adults were observed, July 22, on the alplands.

Golden-crowned Kinglet--Regulus satrapa Lichtenstein

Observed in coniferous forests in all the regions visited including a stand of alpine fir near timberline on Rocher Deboule. At Puntchesakut Lake the male of a mated pair was heard singing May 18, and the behaviour of a mated pair in thick alpine fir woods at Summit Lake indicated that young were being fed. It was probably the most abundant forest bird at Sixteen Mile Lake and at Puntchesakut Lake in late August. At the last place as many as 20 or 30 sometimes were called up at one time by means of the pigmy owl whistle.

Ruby-crowned Kinglet--Regulus calendula (Linnaeus).

At Puntchesakut Lake ruby-crowned kinglets were a conspicuous element in the migration of small birds that moved through the brush on the lakeshore between May 6 and May 24. At the same time the loud song was the dominant sound in the forest and there, in the latter part of this period, pairs were established on nesting territories. An autumn migration was in progress in this region during the first week in September, most of the small groups observed being in company with Audubon warblers and golden-crowned kinglets. On September 5, two, presumably adult males, were heard singing; the majority, thought to be young of the year, were silent except that the alarm note was given when one became excited at the sounds I made to attract small birds.

The species was observed also at Bouchie Lake, June 5, June 6; Dale Lake, June 20; Chief Lake, July 8; Bulkley Lake, July 27, and Francois Lake, on migration, August 9.

Alpine Pipit--Anthus spinoletta (Linnaeus).

A flock of 16 on a meadow at Puntchesakut Lake, May 6, and two flocks, numbering six and twenty respectively, at Tiltzarone Lake, September 1, were the only observations of the spring and autumn migrations.

In the Rocher Deboule Mountains, on July 22, several adults and full grown young were observed in flight and perched on boulder tops in the alplands. The young were in the spotted plumage and evidently had quite recently left the nest.

Bohemian Waxwing--Bombycilla garrulus (Linnaeus).

One mated pair observed in each of two localities, viz.; Chief Lake, July 5, and Lacroix Lake, July 14 In the last instance the two birds, attracted by the imitation of a pigmy owl call, alighted near the top of a dead tree that stood amongst thick alders on the lakeshore Dr. G. R. Baker told me of seeing a pair at Sixteen Mile Lake on June 1, 1944, and said also that the species was seen there each summer. According to reports received at Puntchesakut Lake large flocks sometimes visit that place in winter and Mr J Sugden has noted it common in winter at Francois Lake.

Cedar Waxwing--Bombycilla cedrorum Vieillot.

First recorded at Bouchie Lake on June 7 when five, evidently new arrivals, alighted in the branches of a tall willow under which I stood. These or others were noted in the same locality on June 12 and June 15 Other records are: Dale Lake, June 20, 4; Summit Lake, June 28, June 29, 1 pair; Nukko Lake, July 4, 1 pair; Bulkley Lake, July 29, 1 pair; Francois Lake, August 7, 1; Sixteen Mile Lake, August 28, 1.

Northern Shrike--Lanius excubitor Linnaeus.

Probably a regular transient through the valleys of central British Columbia. Mr J Sugden in a personal letter mentions it as a winter visitant to Francois Lake, more plentiful than usual in the winter of 1942-43.

Solitary Vireo--Vireo solitarius (Wilson).

Identified with certainty, by observation, and by the song, at Puntchesakut Lake on May 20, May 24, and May 30. It was heard also at Sixteen Mile Lake on August 24 and August 30, and at Tiltzarone Lake on September 4 A young female in first winter plumage was taken at Bouchie Lake on August 17.

Golden crowned Kinglet--Regulus satrapa Lichtenstein

Observed in coniferous forests in all the regions visited including a stand of alpine fir near timberline on Rocher Deboule. At Puntchesakut Lake the male of a mated pair was heard singing May 18, and the behaviour of a mated pair in thick alpine fir woods at Summit Lake indicated that young were being fed. It was probably the most abundant forest bird at Sixteen Mile Lake and at Puntchesakut Lake in late August. At the last place as many as 20 or 30 sometimes were called up at one time by means of the pigmy owl whistle

Ruby-crowned Kinglet--Regulus calendula (Linnaeus).

At Puntchesakut Lake ruby-crowned kinglets were a conspicuous element in the migration of small birds that moved through the brush on the lakeshore between May 6 and May 24. At the same time the loud song was the dominant sound in the forest and there, in the latter part of this period, pairs were established on nesting territories. An autumn migration was in progress in this region during the first week in September, most of the small groups observed being in company with Audubon warblers and golden-crowned kinglets. On September 5, two, presumably adult males, were heard singing; the majority, thought to be young of the year, were silent except that the alarm note was given when one became excited at the sounds I made to attract small birds.

The species was observed also at Bouchie Lake, June 5, June 6; Dale Lake, June 20; Chief Lake, July 8; Bulkley Lake, July 27, and Francois Lake, on migration, August 9.

Alpine Pipit--Anthus spinoletta (Linnaeus).

A flock of 16 on a meadow at Puntchesakut Lake, May 6, and two flocks, numbering six and twenty respectively, at Tiltzarone Lake, September 1, were the only observations of the spring and autumn migrations.

In the Rocher Deboule Mountains, on July 22, several adults and full grown young were observed in flight and perched on boulder tops in the alplands. The young were in the spotted plumage and evidently had quite recently left the nest.

Bohemian Waxwing--Bombycilla garrulus (Linnaeus).

One mated pair observed in each of two localities, viz.; Chief Lake, July 5, and Lacroix Lake, July 14. In the last instance the two birds, attracted by the imitation of a pigmy owl call, alighted near the top of a dead tree that stood amongst thick alders on the lakeshore. Dr. G. R. Baker told me of seeing a pair at Sixteen Mile Lake on June 1, 1944, and said also that the species was seen there each summer. According to reports received at Puntchesakut Lake large flocks sometimes visit that place in winter and Mr. J. Sugden has noted it common in winter at Francois Lake.

Cedar Waxwing--Bombycilla cedrorum Vieillot.

First recorded at Bouchie Lake on June 7 when five, evidently new arrivals, alighted in the branches of a tall willow under which I stood. These or others were noted in the same locality on June 12 and June 15. Other records are: Dale Lake, June 20, 4; Summit Lake, June 28, June 29, 1 pair; Nukko Lake, July 4, 1 pair; Bulkley Lake, July 29, 1 pair; Francois Lake, August 7, 1; Sixteen Mile Lake, August 28, 1.

Northern Shrike--Lanius excubitor Linnaeus.

Probably a regular transient through the valleys of central British Columbia. Mr. J. Sugden in a personal letter mentions it as a winter visitant to Francois Lake, more plentiful than usual in the winter of 1942-43.

Solitary Vireo--Vireo solitarius (Wilson).

Identified with certainty, by observation, and by the song, at Puntchesakut Lake on May 20, May 24, and May 30. It was heard also at Sixteen Mile Lake on August 24 and August 30, and at Tiltzarone Lake on September 4. A young female in first winter plumage was taken at Bouchie Lake on August 17.

Red-eyed Vireo--Vireo olivaceus (Linnaeus).

Recorded by sight, or on the basis of song, at the following places: Puntchesakut Lake, June 5; Bouchie Lake, June 6; Summit Lake, June 27; Nukko Lake, July 7. It was not common at any place and was not recorded west of Nukko Lake

Warbling Vireo--Vireo gilvus (Vieillot).

First seen at Puntchesakut Lake, May 18, and again at Tiltzarone Lake on May 24 It was noted as common in this region, where males were singing freely on May 30, and at Bouchie Lake on June 6. Other records are: Dale Lake, June 20; Summit Lake, June 25; Telkwa, June 14; Smithers, June 15; Francois Lake, August 12; Bouchie Lake, August 17; Sixteen Mile Lake, August 23

Tennessee Warbler--Vermivora peregrina (Wilson).

First observed on May 27 at Puntchesakut Lake. In the week following it became common and the unmistakable song could be heard coming from the tops of tall aspens where the birds themselves were usually invisible It was seen and heard singing near Quesnel on June 8 and was quite plentiful at Summit Lake in the latter part of that month. A number of times, while I walked the length of a road that passes through deciduous trees near the lakeshore, it was observed that a male preceded me flying from tree to tree and singing from a concealed perch in each. On one occasion, June 27, a male flying ahead of me in this manner covered a total distance of approximately 200 yards but it was not until the end, when he sang from a conspicuous position near the outer end of a branch, that the bird was seen None was observed west of Prince George The only record made during the autumn migration was at Sixteen Mile Lake where one was observed at close range in the lakeshore brush on August 28

Orange-crowned Warbler--Vermivora celata (Say).

Three seen at Puntchesakut Lake on May 8 and two on May 10 were the first recorded May 18 was a cold, windy day but small birds that perhaps had arrived during the night were plentiful in the brush and aspen stands by the lakeshore. Not the least plentiful were orange-crowned warblers of which 35± were counted within a small area. Amongst those observed at close range were some conspicuously brighter in colour than others and it was concluded that two subspecies were included, viz.; Vermivora celata celata (Say), and Vermivora celata orestera Oberholser.

For the most part these warblers remained in the tree tops moving about restlessly but singing freely so that their presence often was detected by hearing only. A limited autumn migration was observed at this place on September 2 A specimen collected on that date is identified as the northern subspecies Vermivora celata orestera.

The species was identified also at Bouchie Lake on June 6 when a male was seen and heard singing. Here also on August 18 an example of the subspecies V. c. Orestera was collected. This is a male in first-winter plumage.

Yellow Warbler--Dendroica petechia (Linnaeus).

Identified satisfactorily only at Hazelton, July 25, and at Francois Lake, August 4

Magnolia Warbler--Dendroica magnolia (Wilson).

First noted on June 9 near Quesnel where at least three males were seen and heard singing in tall birches. At Summit Lake it was perhaps the most abundant warbler in a lowland habitat of willow, alder and other shrubbery Recorded also at Nukko Lake, July 5, and at Bouchie Lake during the autumn migration where a male in first-winter plumage was taken on August 18. None was observed west of the vicinity of Prince George.

Audubon Warbler--Dendroica auduboni (Townsend).

Noted as an abundant transient at Puntchesakut Lake, between May 6 and May 24 The migration continued for several weeks after a local population had commenced breeding. Pairs were seen in close company, and males in pursuit of females, as early as May 17. One such pursuit witnessed in the evening of May 19 ended by the two coming together in mid-air and tumbling down several feet before separating and righting themselves. The preferred nesting habitat seemed to be semi-open places in the lodgepole pine and aspen forest.

Audubon warblers, probably nesting, were recorded also at Bouchie Lake, June 7, Nukko Lake, July 8 and Lacroix Lake, July 15 At Summit Lake on June 30 a pair was seen feeding young; it was much less common there than were Tennessee warbler, magnolia warbler and redstart. None was observed at Bulkley Lake, in the Smithers District nor at Hazelton.

An autumn migration made up of young in, or moulting to, first-winter plumage was noted first at Francois Lake on August 7; by August 15 the movement had reached larger proportions. A migration was in progress at Puntchesakut Lake between August 31 and September 6

Water Thrush--Seiurus noveboracensis (Gmelin).

In the Baker Creek Valley this species was rare, or else it had not reached the locality in any numbers up to the time I left there on June 5. Only one was recorded, viz.; Puntchesakut Lake, May 30. At Bouchie Lake and at Summit Lake it was exceedingly common and was observed also at the following places: Chief Lake, July 7; Nukko Lake, July 8; Fraser Lake, July 10; Telkwa and Smithers Districts, July 11 to July 16; Bulkley Lake, July 27; Francois Lake, August 10

At Bouchie Lake pairs were established in willow and alder thickets at many places along the lakeshore. The loud, insistent song was heard at all hours but usually the singer remained concealed in thick cover. Sometimes, however, when I had paddled along shore close to the alders one could be excited to the extent of showing itself and would appear suddenly a few feet away in the shrubbery. All apparently had left the vicinity when I returned to Bouchie Lake on August 16

At Summit Lake, June 27, two pairs that were feeding young came under observation. The bold, fearless behaviour of these was in marked contrast to that witnessed earlier in the month at Bouchie Lake. Thus both the male and female of one pair, each with food in the bill, alighted in a tree only a few yards from where I stood, and moved about on several bare branches in the charactertistic jerky manner. Another pair in an open clump of small spruce made no attempt to conceal themselves and responded instantly to a 'squeak.' The territories of these particular birds were a mile or so from water, but at Summit Lake, as elsewhere, the habitat favoured by the majority was the deciduous growth along the lakeshore.

Macgillivray Warbler--Oporornis tolmiei (Townsend).

At Bouchie Lake this warbler frequented low thickets of black twin-berry, cow parsnip, nettles, and other shrubbery. It was seen first, June 7 and again on June 12. At Summit Lake, June 25, a male, under observation for several minutes in a thicket of thimble berry, carried food in its bill and apparently was engaged in feeding young.

It was noted also at Nukko Lake, Bulkley Lake, Hazelton and Rocher Deboule. In the last place it was quite common in low thickets on open mountain slopes between 4,000 and 5,000 feet altitude; here adults were seen feeding young on July 21. The population at Bulkley Lake was largely restricted to islands of shrubbery on a hay meadow. A migration of young in the first winter plumage was observed at Francois Lake on August 9.

Yellow Throat--Geothlypis trichas (Linnaeus).

On May 31 yellow throats were seen in relatively large numbers in a sedge marsh dotted with willows along Puntataenkut Creek. These were the first recorded. Several pairs nested at Bouchie Lake, and at Summit Lake it frequented, and apparently nested, in dwarf birch and willow shrubbery by the lakeshore where males were seen and heard singing on June 26. It was noted in similar surroundings at most of the lakes visited in the Telkwa and Smithers Districts. At Bulkley Lake on July 28 adults were feeding young in the nest and at least one brood of flying young in juvenile plumage was observed. Here it was plentiful in the brushy thickets nearest to flooded marsh and lakeshore, while a similar but drier habitat a short distance inland was unoccupied or nearly so.

Black-capped Warbler--Wilsonia pusilla (Wilson).

This was a conspicuous spring transient at Puntchesakut Lake where the first was noted on May 8 and the second on May 10, both records being for a single adult male. On May 11 at least 18 were observed in shrubbery along the sunny west shore of the lake in early morning. All examined at close range were males; a female was not identified until May 21. The migration continued in varying volume until May 28, the last record being for a single bird on May 30.

None was observed during the summer; the first autumn transients, were encountered at Francois Lake on August 9.

Redstart--Setophaga ruticilla (Linnaeus).

An adult male at Puntchesakut Lake, May 28, was the first and only observation for that general region. At Bouchie Lake, June 6 and subsequently, it was one of the commonest birds and usually the first to appear in response to squeaking or an imitation of the pigmy owl whistle. It was equally abundant at Bulkley Lake in late July and was noted elsewhere during mid-summer as follows: Nukko Lake, July 8; Smithers, July 12; Lacroix Lake, July 14; Maclure Lake, July 15; Hazelton, July 17.

An autumn migration was in progress at Francois Lake between August 5 and August 9, and at Bouchie Lake from August 17 to August 19.

English Sparrow--Passer domesticus (Linnaeus).

Observed in small numbers in the towns of Quesnel, Prince George and Hazelton. At Francois Lake, August 4 to August 13, a flock of 12±, frequented a farm yard and roosted in the farm buildings.

Western Meadowlark--Sturnella neglecta Audubon.

Seen or heard at Quesnel, May 6; Dragon Lake, June 8; Bouchie Lake, June 15; Dale Lake, June 20. It was not plentiful and none was seen north of the Quesnel region.

Yellow-headed Blackbird--Xanthocephalus xanthocephalus (Bonaparte).

Four males were observed in a sedge marsh along Puntataenkut Creek on May 16. None was seen at that place when it was next inspected on May 31 so it can be concluded that these were transients. None was seen elsewhere during the summer.

Red-winged Blackbird--Agelaius phoeniceus (Linnaeus).

This blackbird was found to be widely distributed, but not particularly abundant anywhere. The largest populations were at

Puntataenkut Creek and at Dragon Lake. At the former place on May 31 the number inhabiting some 75 acres of sedge marsh was estimated to be 20 pairs. The population of Dragon Lake, that has a shoreline of 12 miles or so much of it bordered by round-stem bulrush marsh, was 30 pairs±.

Three pairs nested in a cattail marsh at Bouchie Lake. A nest situated 12 inches from the water in a cattail clump was made of sedges with a lining of fine grass, and contained four eggs on June 8 A brood of flying young was noted there on June 17.

Other small populations were: Milburn Lake, June 10, 3 pair; Dale Lake, June 20, 1 pair; Nukko Lake, July 4, three pair and a brood of flying young in a round-stem bulrush marsh; Nukko Creek, July 7, two pairs nesting in cattails; Kathlyn Lake, near Smithers, July 13, 3 pairs; Lacroix Lake, July 14, 4 adults, 1 brood of flying young; Maclure Lake, July 15, 6 adults, 1 brood of flying young.

At Bouchie Lake, Milburn Lake and Lacroix Lake adults were observed walking on the lily pads, perhaps attracted by the larvae of the 'lily pad beetle' Galerucella nymphaea.

Two adult males and one adult female collected at Tiltzarone Lake, May 6 are identified as the subspecies Agelaius phoenicus arctolegus Oberholser

Rusty Blackbird--Euphagus carolinus (Müller).

At Puntchesakut Lake, May 30, two males of this species alighted near the top of an aspen by the shore and performed a simple display that consisted of stretching one wing downward to its full extent, then whistling a single note. One of these birds was collected and proved to be in breeding condition. At Bulkley Lake, July 27, a female and brood of full grown young were observed several times in the alders along the creek, and one of the juvenals was collected On the evening of that day a flock of 30± blackbirds that hunted grasshoppers over newly cut hay contained several females and young of this species, the former distinguished from female Brewer blackbird by the yellow-coloured iris. Some of the adult males in this flock may have been rusty blackbirds as not all were satisfactorily identified The species was identified with certainty on one other occasion, viz.; at Sixteen Mile Lake, August 17, when a young bird in first winter plumage was observed in a willow thicket beside the lake.

Brewer Blackbird--Euphagus cyanocephalus (Wagler).

Observed in small flocks along the highway between Alexandria and Quesnel on May 5, and at Puntchesakut Lake on May 8. There also on May 9 a flock of 15 males and five females that had been attracted by a pile of stable refuse came under close observation. All were definitely of this species. None was observed subsequently in the vicinity and apparently it did not nest there.

At Chief Lake, July 5, a flock consisting of four adult males, one adult female and three young hunted food in an open place about some farm buildings; these also were identified satisfactorily.

At Kathlyn Lake, near Smithers, an adult male and an adult female were collected, and four others seen, on July 13. Flocks were observed also at Lacroix Lake, July 14 , 8; Smithers, July 15, 30±, Bulkley Lake, July 26, July 29, 20±; Francois Lake, August 4, 50±; all these flocks, except the first mentioned, were feeding on grasshoppers when under observation.

Cowbird--Molothrus ater (Boddaert).

Relatively common in lowland regions and particularly so at Bouchie Lake where the first, three males, were recorded on June 6. At Chief Lake on July 7 an adult male and female were accompanied by a striped young. The latter fluttered its wings and assumed the attitude, usually described as begging for food, before each of the adults in turn.

Other observations are: Dragon Lake, June 9, one female; Summit Lake, June 25, heard; highway between Vanderhoof and Endako, July 10, 8±; Bulkley Lake, July 27, 1 male, 1 female together; Francois Lake, August 12, 1 young bird with flock of Brewer blackbirds.

Western Tanager--Piranga ludoviciana (Wilson).

Noted at numerous places west to Hazelton. The first recorded arrival was on May 19 at Puntchesakut Lake. This was a singing male, and it or another was heard near the same place the following day and again on May 29 and June 5; another was recorded at Bouchie Lake on June 12. A pair was observed several times at Summit Lake in the latter part of June, and at Nukko Lake in early July both males and females were seen frequently. Other records are Lacroix Lake, July 14; Seeley Lake, July 24; Hazelton, July 25, and Francois Lake, August 4. The last refers to a young male in first winter plumage.

Evening Grosbeak--Hesperiphona vespertina (Cooper).

The only evidence concerning the distribution of this species was supplied by Dr. G. R. Baker who reported seeing several at Sixteen Mile Lake on June 18, 1944

Purple Finch--Carpodacus purpureus (Gmelin).

Several males frequented particular sections of the aspen woods in the Puntchesakut Lake district and were heard singing from May 9 to May 24. The only female seen was in the company of two red males on May 11. A mated pair was recorded at Nukko Lake, and at Bulkley Lake a population that included several pairs and their flying young were several times observed feeding on black twin-berries. Two specimens collected identify the subspecies as Carpodacus purpureus purpureus (Gmelin).

Pine Grosbeak--Pinicola enucleator (Linnaeus).

A female of this species was collected at Puntchesakut Lake on May 30. It was the only one seen; it was not in breeding condition and presumably was a wanderer. One was seen just below timberline on Rocher Deboule, July 19, and for several days following this bird or another was heard singing near the same place.

The specimen is identified as Pinicola enucleator montana Ridgway.

Rosy Finch--Leucosticte tephrocotis (Swainson).

A solitary young bird in juvenile plumage was twice seen, July 22, July 23, and subsequently collected, beside an old miner's cabin that stands on a small alp on Rocher Deboule. Very likely this bird came from one of the high, rugged peaks, the bases of which are not far back of the alplands

The specimen is identified as Leucosticte tephrocotis littoralis Baird.

Pine Siskin--Spinus pinus (Wilson).

Two couples, evidently mated pairs, and a flock of 12 were seen on the Nazko Road east of Puntchesakut Lake on June 5, and a flock of 10 was noted, June 8, near Quesnel. Other records are: Summit Lake, June 25, 2 pairs; Nukko Lake, July 8, 1 pair; Endako, July 10, flock of 8±; Rocher Deboule Mountains at timberline, July 20, 20±; Bulkley Lake, July 27, flock 10±; Francois Lake, August 1, 5.

Red Crossbill--Loxia curvirostra Linnaeus.

Settlers at Puntchesakut Lake told of seeing, usually in spring, flocks of small, red birds that ate the seeds from the spruce cones. This might refer to either or both crossbills. None was seen during the summer. The apparent absence of crossbills has also been noted during the past three years in various localities of southern British Columbia from the Rocky Mountains to Vancouver Island. The vagrant habit of this species is perhaps not sufficient in itself to account for the fact that so large a territory should be unoccupied, or nearly so, for so long a period. Neither in this particular territory is the present absence and former abundance co-related with a scarcity and abundance of the cone crop. It seems possible, rather, that the virtual disappearance of crossbills at irregular intervals may be the result of periodic nesting failures that reduce the population to such a low level that a number of years are required for full recovery.

It is my opinion that the post-breeding mortality amongst adults of small bird species is very high, and that only a small percentage survives the first nesting season. If this is so, then it becomes evident that the size of any year's nesting population is largely dependent upon the number of young raised to maturity during the previous year. This hypothesis would apply to all small birds but in the case of the crossbill, and other species conspicuous by reason of their flocking habit, the recurring periods of scarcity and abundance are much more obvious.

White-winged Crossbill--*Loxia leucoptera* Gmelin.

A mounted specimen in the collection of J. B. Langston was examined. This bird was caught in a trap set for coyote near Smithers in the winter of 1943-44.

Savannah Sparrow--*Passerculus sandwichensis* (Gmelin).

First recorded at Puntchesakut Lake, May 11, when three transients were observed on a grassy place by the lake. Not seen again until May 24. On that date a male sang from the top of a solitary willow in a sedge meadow; it flew from there to an adjacent aspen stand then back to the willow and sang again. Evidently this was a nesting territory but no other savannah sparrows were found there. Several other singing males were recorded at Tiltzarone Lake and at Goose Lake on May 24.

The species was not met with again until the latter part of July at Bulkley Lake where both adults and flying young were common in a meadow dotted with willow thickets.

It was common on migration at Ootsa Lake, August 3, and Francois Lake, August 4. Smaller numbers of transients were recorded at Bouchie Lake, August 18; Goose Lake, September 1, and Puntchesakut Lake, September 5.

Vesper Sparrow--*Pooecetes gramineus* (Gmelin).

One record only for Baker Creek Valley where at Puntchesakut Lake, May 19, a male that apparently had just arrived was seen and heard singing. Other records are: Bulkley Lake, July 27; Ootsa Lake, August 3; Francois Lake, August 4, August 8. At no place was it particularly common.

Lark Sparrow--*Chondestes grammacus* (Say).

A female lark sparrow was collected on May 18 in a small clearing in the forest--an abandoned homestead--near Puntchesakut Lake. This locality is far north of the species' range in British Columbia that is restricted to the dry southern interior and does not extend north of the open grasslands of the Kamloops-Ashcroft region.

Oregon Junco--Junco oreganus (Townsend).

One of the commonest birds in all the regions visited including timberline habitat on Rocher Deboule. At Puntchesakut Lake a migration, involving numerous flocks of five or six birds, was observed from May 8 until May 23. During the summer broods of young were met with at various places. A migratory movement was observed first at Francois Lake on August 4, and the number of transients increased in the week that followed. At Puntchesakut Lake flocks containing 20 birds and more were seen frequently.

The subspecies represented is Junco oreganus montanus Ridgway

Chipping Sparrow--Spizella passerina (Bechstein).

The first chipping sparrows, two, were recorded at Puntchesakut Lake on May 8. It was found in varying degrees of abdunance, and nesting in all the localities visited, except Rocher Deboule where none was seen. The first young, being fed by parents, were observed at Nukko Lake on July 5 and the first movement of transients, chiefly young, on July 26 On this date an estimated 200 were recorded along the 20 miles of highway between Houston and Topley.

Another migration of 50±, all young, was observed at Francois Lake, August 4 These were passing through and alongside a dry, wooded, creek-bottom. None was seen again in the vicinity until August 8.

The subspecies represented is Spizella passerina passerina (Bechstein)

Clay-coloured Sparrow--Spizella pallida (Swainson).

An adult female of this species was collected at Bulkley Lake on July 27. This was the only one recorded

White-crowned Sparrow--Zonotrichia leucophrys (Forster).

Noted on migration near Quesnel on May 5, and at Puntchesakut Lake from May 8 to May 12 inclusive. It was not common there; the largest flock numbered eight and not more than 30 were counted in one day. None was seen after May 12 and apparently it did not nest in the region.

The species was not seen again until I reached Smithers. Here on July 14 a pair, evidently nesting in a wooded lot within the village, came under observation. An adult male, thought to be a nesting bird, was seen near Hazelton on July 24, and at Ootsa Lake, August 3, a brood of young partly moulted to first winter plumage was noted. At Francois Lake, August 4 and at Shafer Lake, August 7, young in first winter plumage were migrating in small numbers. Other migrations involving smaller numbers were observed at Sixteen Mile Lake, August 28, and Puntchesakut Lake, September 2 and September 3

The subspecies represented is Zonotrichia leucophrys gambeli (Nuttall)

Golden crowned Sparrow--Zonotrichia coronata (Pallas).

A female collected at Puntchesakut Lake on May 9 was the only one of this species observed on migration. A population inhabiting a brushy hillside at 4,500 to 5,500 feet altitude on Rocher Deboule was studied during the period July 19 - July 25 It consisted of adults and young out of the nest, some in juvenile plumage and not fully grown, others moulting to first winter plumage The adults were conspicuous and fearless, some, with food in the bill, perched on the top of procumbent firs (Fig 41), and some of the males were still in song The young for the most part kept hidden in thick cover; they were hard to find and the actions of the parents tended to conceal their location

Fox Sparrow--Passerella iliaca (Merrem).

Fox sparrows were heard singing at several places on Rocher Deboule on July 20. None was seen at close range.

Lincoln Sparrow--Melospiza lincolnii (Audubon).

A pair was seen feeding young in a muskeg at Summit Lake on June 27 and one other pair, also thought to have young, was observed in a similar habitat half a mile distant. On Rocher Deboule an adult was observed feeding young in a thicket by a small creek on July 20. At Bulkley Lake adults and full grown young frequented a habitat of meadow and willow thicket. It was seen on migration at Bouchie Lake, August 18, and at Puntchesakut Lake, September 2.

Song Sparrow--Melospiza melodia (Wilson).

Found nesting commonly in all the regions visited except Baker Creek Valley and Rocher Deboule. Its absence from the former region was surprising as it was present in seemingly less suitable habitats at Summit Lake and Sixteen Mile Lake.

A nest at Bouchie Lake, made of dry grass and aspen bark and lined with moose hair, was situated six inches above ground in the centre of a small dead willow. This contained four eggs on June 6. Another, made of dry sedge strips and lined with fine grass, was on the ground in a strip of sedge marsh between a willow thicket and the inner edge of a cattail marsh. It contained four naked young on June 8. It was estimated that 10 pair nested along a quarter mile of shrubbery and willows on the west end of the lake.

At Summit Lake at least 10 pair occupied thickets of dwarf birch, black twin-berry and hardhack that featured the shores of a small bay on the east side of the lake. The behaviour of singing males and the actions of the females indicated that young were being fed when this place was visited on June 27. Males were heard singing in a muskeg at Summit Lake and in a muskeg at Swamp Lake. At other places--Nukko Lake, Fraser Lake, Francois Lake, Bulkley Lake, Smithers and Hazelton, they occupied willow and alder bottoms. At Sixteen Mile Lake the preferred habitat was a jungle of deciduous growth along a small creek that flowed through a narrow valley in deep, coniferous forest.

The subspecies represented is Melospiza melodia inexpectata Riley.

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POPULATIONS OF SMALL MAMMALS

The trapping of small mammals was carried on at the following localities between the dates noted: Baker Creek Valley, May 12 - June 3; Bouchie Lake, June 13 - 18; Summit Lake, June 25 - July 2; Nukko Lake, July 7 - 8; Rocher Deboule, July 20 - 22; Sixteen Mile Lake, August 21 - 29; Tiltzarone Lake, August 31 - September 1. A total of 400 small mammals was trapped. The species taken most frequently were, in order of abundance, meadow vole Microtus pennsylvanicus, red-backed vole Clethrionomys gapperi, white-footed mouse Peromyscus maniculatus, jumping mouse Zapus princeps and dusky shrew Sorex obscurus.

The periodicity cycle of scarcity and abundance, common to all small mammals, is perhaps most conspicuous in the meadow vole that makes lasting runways and burrows which reveal the presence or absence of the animal. The summer's investigations suggest that the cyclic rhythm in the meadow vole, and the red-backed vole also, operates not as a widespread and synchronized phenomenon but over different time periods in different localities that may be adjacent. For example, in the Baker Creek Valley meadow voles were beginning to recover from a period of scarcity; at Bouchie Lake, 24 miles distant to the east, the up-swing was at a more advanced stage, while at Sixteen Mile Lake, 22 miles farther east and separated from the other two localities by the Fraser River, the peak of abundance probably had been reached. The cyclic pattern of the red-backed vole apparently was synchronous with that of the meadow vole at Baker Creek Valley, Sixteen Mile Lake and Nukko Lake. At Bouchie Lake it was at a low point in the population curve and at Summit Lake, where meadow voles were scarce, it was nearing a peak (see Table III).

In the Baker Creek Valley trapping was done in dry, open, lodgepole pine and aspen forest, in muskegs, dwarf birch thickets, marshy lakeshore and dry meadows. The results obtained indicated that while the meadow vole and red-backed vole were on the upswing of the cycle, as has been noted, the mice and shrew populations were at or near the minimum. The product of 641 trap-nights was 52 specimens of which 37 were voles, all but six being adult animals.

Trapping at Bouchie Lake in aspen woods, marshy meadows, creek banks and dry meadows produced 30 meadow voles, 1 red-backed vole and 25 mice and shrews, a total of 56 specimens in 216 trap-nights.

The habitat at Sixteen Mile Lake, chiefly deep coniferous forest, is quite different from either the Baker Creek Valley or the Bouchie Lake regions. Trapping along old trails, by a small creek, and in forest clearings, revealed that the meadow vole and the red-backed vole had reached almost plague proportions while mice and shrews were more abundant than elsewhere. During the twenty-four hours following 8:30 p.m., August 21, a total of 54 animals, chiefly voles, was captured in 36 traps. In this time one trap set across a runway, which passed under a wood pile, caught nine mammals and during the entire trapping period of eight days a total of 19 was captured in this trap. The number of all species taken in 302 trap-nights totalled 227 of which 176 were voles. Nineteen of the total number were partly eaten in the traps, by voles or shrews, before being recovered. So far as could be learned no fur-bearing animals nor raptores were attracted to this abundant supply of food.

Nowhere else were small mammals found in such numbers. Specimen returns on a trap-night basis in other localities are as follows:

Summit Lake, $\frac{32}{183}$, Nukko Lake, $\frac{20}{50}$, Rocher Deboule, $\frac{8}{90}$.

It is well-known that mice and voles constitute one of the main sources of food for various kinds of fur-bearing animals and it is believed that voles represent the element of chief importance in this food potential. Voles are sedentary animals whose life-span normally is spent within a narrowly circumscribed area and thus they represent a more accessible food than do the free-moving mice.

It seems necessary to emphasize the fact that the cycles of different species in the various groups do not usually coincide in time. In any given region mice of one species or another may be scarce at a time when one, or perhaps two, species of voles are abundant, or the opposite condition may prevail. The periodicity cycle if uniform in time over a large territory might be disastrous to the fur-bearing animals which feed upon them; operating locally it becomes a survival factor of importance. This staggered cycle may also explain why mass movements of small carnivora from one place to another sometimes occur.

It is not known to what extent carnivorous fur-bearing animals feed upon shrews; they are repellent to domestic cats and a distaste for them may be general amongst the small carnivora. However, it is of interest to point out the fact that the cyclic pattern of shrews operates on the same local basis as does that of voles and mice.

TABLE III

Populations and Per Cent Proportions of Six Common Mammals

Locality	Sorex cinereus	Sorex obscurus	Peromyscus maniculatus	Clethrionomys gapperi	Microtus pennsylvanicus	Zapus princeps	Dates	Total Trapped	Trap-Nights
Baker Creek Valley	9.61		5.77	11.54	65.39	7.69	May 12 - June 3 Sept. 1 - 3	52	641
Bouchie Lake	1.79		28.57	1.79	53.57	14.28	June 13 - 18	56	216
Sixteen Mile Lake		8.15	9.50	40.72	38.91	2.72	Aug. 21 - 29	221	302
Summit Lake	25.00	15.00		42.50	10.00	7.50	June 25 - July 2	40	183
Nukko Lake			38.89	22.22	33.33	5.56	July 7 - 8	18	50

ANNOTATED LIST OF MAMMALS

Masked Shrew--Sorex cinereus Kerr.

Not particularly common anywhere. Five were trapped at Baker Creek Valley in 641 trap-nights during May. This number including a female on May 16 with five embryos and another on May 20 that held eight embryos. One was taken in aspen woods, the others in meadow vole runways through sedge meadows. The species recently had been much more common. A small owl pellet measuring two inches by one-half inch, one that might have been cast by a saw-whet owl or little boreal owl, was composed entirely of shrew remains. It contained, amongst other shrew bones, seven rostra of cinereus shrew and one rostram of another species, probably dusky shrew. At Bouchie Lake only one was trapped in 216 trap-nights; at Summit Lake three in 183 trap-nights, and at Sixteen Mile Lake seven in 302 trap-nights, were taken.

Dusky Shrew--Sorex obscurus Merriam.

Found only at Summit Lake and Sixteen Mile Lake. At the former place two adult males were trapped, one in a meadow vole runway through a wet bog, another beside an adjacent stone pile. These are unusually large, the measurements being: male, total length, 126, tail vertebrae, 53, hind foot, 13; female, total length, 118, tail vertebrae, 50, hind foot, 13 Fifteen specimens, the majority young animals, were trapped in 302 trap-nights at Sixteen Mile Lake.

Water Shrew--Sorex palustris Richardson.

Traps set along a small stream near Sixteen Mile Lake caught two adult specimens in approximately 60 trap-nights. It was not taken elsewhere although sought for in suitable places. Specimens have been taken by John Shelford near Ootsa Lake; other observers reported it from Tiltzarone Lake and Rocher Deboule Mountain.

Pigmy Shrew--Microsorex hoyi Coues.

A specimen of this shrew was taken at Fort St. James about 62 years ago by Roderick McFarlane and sent by him to the Smithsonian Institute. It is recorded also from Hazelton and from other more northern points in British Columbia. Reference to these specimens appears in Jackson' revision of the long-tailed shrews (4). An adult male was collected by McTaggart Cowan at Ootsa Lake on July 15, 1936.

Little Brown Bat--Myotis lucifugus Le Conte.

One bat of this species was taken at Summit Lake on June 29, another at Telkwa on July 15; both are males. The first was the only individual of the species amongst a small number of bats that occupied several spaces between the logs and the superimposed iron sheeting that formed the roof of a house. The second was one of a small colony inhabiting a space behind the wooden sheeting on the walls of a house in Telkwa village.

Both specimens are of the subspecies Myotis lucifugus alascensis Miller.

Little Long-eared Bat--Myotis evotis Allen.

The log and iron sheeting house roof at Summit Lake, referred to above, contained a small colony of this bat. Four females were collected; to one a small young was attached, another contained an embryo. This record extends, by about 300 miles north, the known range of the species in interior British Columbia.

Brown Bat--Eptesicus fuscus (Beauvois).

At Summit Lake, July 29, two large brown bats, believed to be this species, fluttered out from one of the spaces in the house roof already referred to. These were not seen again and bats of this size were not observed elsewhere.

In the summer of 1943 a considerable number of bats occupied the upper portions of the Court House at Prince George and approximately

90 of these were destroyed in the late summer of that year. The species was not determined.

Black Bear--Euarctos americanus (Pallas).

Three bears of this species were seen during the summer; two together on Dale Lake meadow, June 20, and one in open woods at Chief Lake on July 7. All were black and all were large.

In the Baker Creek Valley black bears frequented the small streams during the sucker spawning run in May and fed upon these fish. Beside one small stream that enters the expansion of Puntataenkut Creek a well beaten trail, which obviously had been made by bears while fishing, was examined on May 24. On the same date new faeces contained green sedge and unidentified animal matter. Another faecal deposit found in the same district on June 4 was composed of fine grass, old kinnikinnick berries and the elytra of beetles. Other faecal deposits examined in late August near Bouchie Lake were composed chiefly of blueberries, Vaccinium sps.

Most of the farmers and ranchers regard the black bear not as a game animal but as an undesirable predator on livestock. It appears to be increasing in some localities, and everywhere is at least maintaining its numbers.

Grizzly Bear--Ursus horribilis Ord.

In the spring of 1942 a farmer named Tibbald shot a large grizzly bear near Puntataenkut Lake. This animal, one of two, probably had been attracted to the vicinity by a flock of sheep grazing near Tibbald's house. In 1943 a grizzly bear was reported from Dragon Mountain, about nine miles southeast of Quesnel. An Indian, Henry Hollis, told me one or more had been seen by prospectors in recent years on Ahbou Mountain, northeast of Quesnel.

Grizzly are said to be fairly numerous in the higher mountains along both sides of the Bulkley River and to be not uncommon along the Fraser River above Prince George. In the spring of 1944 a female and two cubs were shot at a logging camp near Torpy River north of Sinclair Mills. This game animal is sufficiently numerous along the Torpy River to provide a local guide with a source of revenue from guiding hunting parties.

Marten--Martes americana (Turton).

Fur royalty returns for the Province show a decrease in marten during the past three years, viz.; from 9,200 in 1941 to 6,540 in 1943 As high prices would encourage trapping it can be assumed that the reduction in numbers indicates a decreased population. The last peak year was 1936 (10,071); the subsequent decline was only slight, viz.; to 8,461 in 1938. The three years following were marked by minor increases to a high of 9,200 in 1941. (See Fig 42.)

A trapper in Baker Creek Valley told me that he used to take marten on his local trap line, worked from Puntchesakut Lake, up to about ten years ago when fire swept over the trapping area; since then none has been captured According to Game Warden Mottishaw marten have recently increased in the region south of the Puntchesakut Lake area; six were trapped by one man, and nine by another, in that general region during the season of 1943-44.

Reports of local increases in other localities have been received, for example in the vicinity of Smithers where a total of 16 was taken last season by three trappers on Hudson Bay Mountain. In more outlying districts adjacent to Smithers catches of eight or more on one trap line were usual.

Trapping in Tweedsmuir Park produced as many as 30 on one trap line; the McNeils, Ootsa Lake, took a total of 55 Exact figures for the total number trapped in the park are not available but it has been placed at 250 to 300.

Martin Shafer, Chief Lake, told me he believed there were no marten in the country between Chief Lake and Carp Lake, the region travelled or trapped by him. The largest number taken on this line in any one year between 1918 and 1927 was 15; presumably his line does not include particularly good marten country.

At Summit Lake a fresh track in the mud on a road through the forest was examined; no animals were seen.

Fisher--Martes pennanti (Erxleben).

The peak years for fisher since 1921 are: 1926, 1,038; 1927, 1,149; and 1942, 1,239 In the interval between 1927 and 1942 the largest returns were: 1928, 887; 1926, 721 The number trapped in 1943, viz.; 446, is the lowest in any year since 1921 and marks a sharp decline from the previous year (Fig 42).

Twenty years ago and earlier Martin Shafer trapped as many as 12 on his line in one season. His recent catches were: 1921, 7; 1942, 3; 1943, 2

Roderick McFarlane (5) states of the fisher that "The district of New Caledonia, British Columbia, gave an average of about 300 skins a year for the years 1885 to 1889. While Fort St. James, Stuart Lake and Fraser Lake always headed the list in nearly equal quantities, the other posts, except Babine, made up the balance with much smaller quotas."

Weasel--*Mustela* *spp.*

No weasels were seen, and no specimens from central British Columbia have been examined. Large numbers are trapped in the settled regions where other more highly-priced fur has been much reduced. Thus in five years at Fort Fraser royalty was paid on a total of 12, 641 weasels. Very likely both short-tailed and long-tailed weasels were represented in these royalty returns; the proportion of each cannot be determined but it is probable that the long-tailed weasel is not common.

Least Weasel--*Mustela* *rixosa* (Bangs).

An adult male of this species, collected by McTaggart Cowan at Ootsa Lake, July 26, 1936, is the only record known to me.

Mink--*Mustela* *vison* Schreber.

Mink represent a staple product on the trap line and the numbers taken are said not to vary greatly from year to year. Martin Shafer trapped 45 along the Salmon and Muskeg Rivers in the season of 1943-1944.

Wolverine--*Gulo* *luscus* (Linnaeus).

It is apparent from comparison of the figures in Table IV, showing yearly return of royalties paid on wolverine at 11 northern centres, that the animal is more abundant in the north

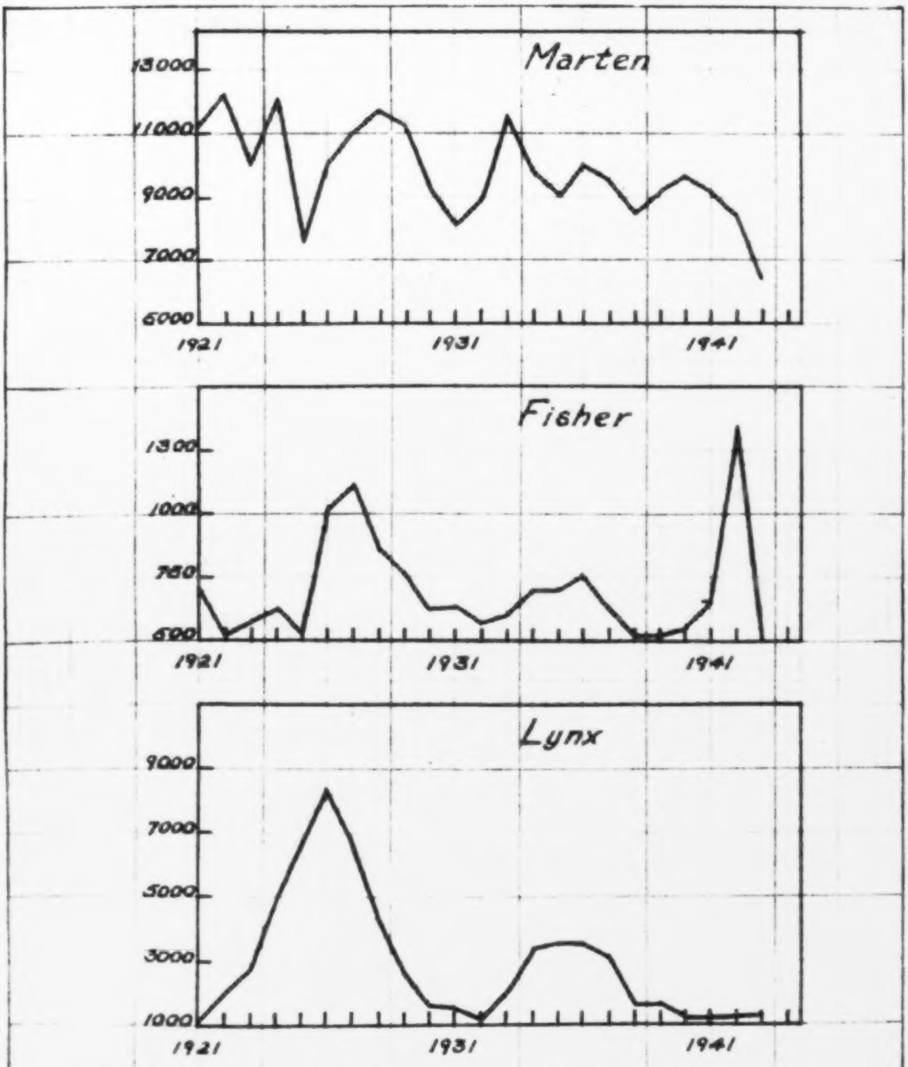


Fig.42 Graphs illustrating catch of marten fisher and lynx, 1921 to 1943

Fig. 42.

than in the south and that the numbers taken vary considerably from year to year. Wolverine are trapped whenever possible, not so much for the value of the fur which is nominal, but because of the animal's destructiveness on the trap line.

The following tabulation does not represent the total of wolverine taken in central and northern British Columbia; a large number of pelts taken at northern points are shipped to Vancouver and the royalties paid there.

TABLE IV

Royalties paid on Wolverine 1938 - 1943

Locality	1938	1939	1940	1941	1942	Totals
Prince George	8	3	20	18	29	78
Fort Fraser	1	0	0	1	9	11
Smithers	8	7	2	11	10	38
Prince Rupert	9	5	2	3	3	22
Pouce Coupe	23	23	10	17	16	89
Telegraph Creek	0	1	0	49	19	69
Atlin	8	15	23	24	22	92
TOTAL for the Province	215	191	213	246	196	1,061

Otter--*Lutra canadensis* (Schreber).

Otter are seen regularly on many of the lakes and streams of the region. In 1943 on Puntataenkut Lake a female and young frequently were observed by various people. Martin Shafer told me he traps one or two each year on the Muskeg and Salmon Rivers. Trappers look on the otter with disfavour because the fur is not particularly valuable and the animal is believed to prey on muskrats. There is some fluctuation in the annual catch but the species seems to be maintaining its numbers.

Northern Skunk--Mephitis hudsonica (Richardson).

Skunks are reported to be rare in the Baker Creek Valley; a local rancher expressed some surprise when one was killed there about August 15 and when others appeared later in the month. The species was equally scarce at Bouchie Lake On the east side of the Fraser River in the Quesnel district and eastward the animal is more common, although no records from Quesnel appear in the royalty returns. It is said to be scarce about Summit Lake, where there is little open country, but more plentiful about Nukko Lake and Chief Lake Reported as not uncommon in the Bulkley Valley and also along the Salmon and Muskeg Rivers where Martin Shafer trapped eight in the season of 1943 - 1944.

A young animal, with body length of about six inches, was watched for several minutes near Nukko Lake as it walked down the road for 20 yards or so then scrambled through brush up a steep bank and disappeared over the summit. Another, a large animal, came into camp at Sixteen Mile Lake and walked about, quite unconcerned, for 20 minutes or more. Faeces examined at Summit Lake were composed mostly of beetle and cricket legs and insect chiton. Others found at Puntchesakut Lake, in late August, were made up chiefly of grasshoppers' remains.

Many more skunks are trapped than would appear from the records of royalties paid. Some trappers do not skin the animals taken because of the work involved in degreasing the hides; others do so only when no more important furs require attention.

TABLE V

Record of Royalties Paid on Skunks at Four Centres In Central British Columbia

Locality	1939	1940	1941	1942	Totals
Prince George	14	31	12	14	71
Fort Fraser	0	2	5	9	16
Smithers	4	7	0	22	33
Pouce Coupe	13	6	3	18	40
Totals	31	46	20	63	160

TABLE VI

Bounties Paid on Coyotes in Central British Columbia 1931 - 1942

Locality	1931	1935	1936	1937	1938	1939	1940	1941	1942	Totals
Williams Lake	338	444	342	215	380	361	404	498	394	3376
Quesnel	111	76	138	65	140	103	96	69	45	843
Barkerville	-	-	2	-	-	-	1	2	-	6
Prince George	183	93	193	89	76	102	69	47	38	890
Pouce Coupe	28	34	41	24	9	21	6	2	4	169
Fort Fraser	147	256	230	130	166	169	197	115	128	1538
Smithers	20	80	57	56	22	30	52	22	27	366
Prince Rupert	18	7	3	2	1	5	16	17	9	78
Totals	845	990	1006	581	795	791	841	772	645	

N. B. Bounties not paid in 1932, 1933, and 1934.

Red Fox--Vulpes alascensis (Merriam).

Fox is a staple product on the trap line but shows wide fluctuations in numbers that probably are directly involved with the rabbit cycle. Mr. Julius Quanstrom told me that at Puntchesakut Lake during a year of rabbit scarcity he found a fox den in which the cubs were dead. Marten Shafer took between 10 and 20 in each year from 1918 to 1929, and in 1930, a peak year, he trapped 38; following this came a decline and subsequent increase. It is reported that in the Bulkley River region there are more silver and cross foxes than red foxes. Here they frequent the river during the salmon run and feed upon the spent fish.

Coyote--Canis latrans (Say).

The presence of coyotes in varying degrees of abundance was detected in all localities visited. Trappers in the Baker Creek Valley expressed the opinion that an epidemic of mange had reduced the numbers of the local population. The skeleton and hair of one that had been eaten, perhaps by other coyotes, during the previous winter may have been a victim of this disease--the bones showed no sign of mechanical injury from bullet or shot wounds. The exact nature of the disease and to what extent it may be fatal is not known to me. However, whether or not the numbers were reduced in the Baker Creek Valley, the total of animals heard, particularly on moonlit nights, the numerous tracks seen and the number of scats found on lakeshore and on forest trails, indicated the presence of a relatively large population.

An attempt to locate a den in thick woods near Dragon Lake was not successful but I did find a sunning place used by a female and family of large pups. This was a mound of sand under an arch formed by the upturned roots of a fallen Douglas fir.

In central British Columbia, as elsewhere, the population fluctuates in numbers and there is reason to believe the fluctuations are cyclic. (See Table VI.) Martin Shafer told me that coyotes are less common on the Salmon and Muskeg Rivers than in regions to the south. He reported finding evidence of one being killed and eaten by wolves and expressed the opinion that where wolves invade a district which is occupied by coyotes the latter are driven out.

Direct observation of the coyote's feeding habits seldom was possible. One animal seen in a wet meadow on the outskirts of Quesnel was obviously hunting mice; another, observed in an open stretch of territory between a fringe of aspen woods and a sedge marsh at Goose Lake, was thought to be similarly engaged. Other observations of coyotes were limited to momentary glimpses of the animals as they disappeared into cover.

A farmer at Dragon Lake reported the loss of three lambs, another the loss of five lambs, from coyote predation--on evidence which seemed conclusive. Many such losses are reported but not always is the predator identified with certainty.

Only one instance of predation on birds was observed, the prey being an adult male ruffed grouse that had been eaten at the edge of a wood road near Goose Lake.

The study of tracks beside the dried-up carcasses of cattle, which had died in winter or early spring, showed that these were still being visited in midsummer.

On the alplands of Rocher Deboule hoary marmots were numerous but there was no indication that coyotes had been attracted to this food; no coyotes were seen and only a single scat, an old one, was found there. Coyote pressure on hoary marmots in other mountain areas of the Province sometimes is excessive.

It is reported that coyotes travel the shores of the Skeena River during the salmon run where they feed upon the spent fish and sometimes capture live ones. It is said also that on this and other rivers coyotes attend the fishing operations of bears and feed upon their leavings.

Some information on food habits was obtained from analyzing the composition of 62 scats of which 43 were fresh, or fairly recent, while the remainder had been deposited in the winter months. The majority was composed of a single item, or a single item represented 70 to 75 per cent of the total bulk. Many contained large amounts of clay, probably eaten for its mineral content, others pine needles or harsh forms of grass.

Because the necessary equipment was lacking it was not possible in every instance to make exact determinations and volumetric percentages were only roughly estimated. The results of the examination are summarized as follow:

COMPOSITION OF 62 COYOTE SCATS

Domestic cattle:	Hair from domestic cattle constituted 40 per cent of the total material in one scat from Bulkley Lake.

Domestic sheep: One scat from Rocher Deboule contained a small amount of sheep's wool. There are no sheep on this mountain so this item must have been eaten elsewhere, probably in the valley below.

Snowshoe rabbit: This was the sole or chief item in each of 15 winter and 21 summer scats from the Baker Creek Valley, and constituted 40 and 50 per cent respectively of the total material in two others. In one instance a rabbit's ear and in another a rabbit's foot had been passed nearly intact. At Bouchie Lake rabbit was represented in amounts ranging from 25 to 75 per cent in each of five scats examined. It formed the chief item in two from Sixteen Mile Lake and the sole constituent in another from Summit Lake. Number of occurrences--49.

Meadow voles: Fur and bones of unidentified microtines formed 30 per cent of the material in each of two scats and 50 per cent of another. Two of these were from Baker Creek Valley, the third from Bouchie Lake. Number of occurrences--3.

Porcupine: Porcupine hair was the sole item in one scat from Baker Creek Valley.

Birds: One scat from Bulkley Lake was composed largely of grebe feathers and bones. This was the only specimen that contained bird remains.

Grasshoppers: One scat from Bouchie Lake contained grasshopper fragments to the extent of 10 per cent; in another from Bulkley Lake this item represented 15 per cent of the total.

Blueberries: Seeds of blueberries Vaccinium sp. composed 20 per cent of the total bulk of one scat from Ootsa Lake and undigested blueberries formed the chief item in three from Baker Creek Valley. Number of occurrences--4.

Pine Needles: Present in small amounts in eight scats from Baker Creek Valley.

Spruce Needles: Present in one specimen from Ootsa Lake.

Miscellaneous Vegetation: Vegetable matter in small amounts, and not further identified, formed a small part of six scats; coarse sedge was the chief constituent of a scat from Rocher Deboule, and one from Baker Creek Valley contained material that seemed to be dried moose dung.

Clay: Clay and earth of different types was a constituent in each of 16 scats from Baker Creek Valley, in three from Bouchie Lake and in one from Bulkley Lake. In seven this material represented 50 to 70 per cent of the total bulk of each scat. Number of occurrences--20.

In central British Columbia, as elsewhere, the coyote is omnivorous in its feeding habits, taking whatever animal food, alive or dead, is easily come by, and eating also a large amount of vegetable matter. In the Baker Creek Valley, the place represented by the largest number of scats, rabbit occurred in all but eight of the 49 specimens examined. Undoubtedly in that locality rabbit was the chief food eaten by coyotes during a period of at least six months prior to May, 1944.

Timber Wolf--Canis sp.

Timber wolves have increased very considerably in central British Columbia during the past 10 or 15 years. All the older residents questioned on this subject told me that in the early days of settlement wolves were scarce or absent. More precisely none was seen in Baker Creek Valley in 1918, nor for some years after that but in recent winters tracks of single animals were found frequently, and a band of five or six was seen a number of times as it crossed Puntchesakut Lake on the ice. In 1943 a total of 70 wolves was destroyed in the Quesnel Game District, of which Baker Creek Valley forms part. The particulars are as follows: January, 8; February, 7; March, 9; April, 15; May, 17; June, 8; November, 6.

Mr. J. B. Hooker informed me that no wolves were in the Torpy River region in 1913; a few were seen after 1918 - 1919; they became abundant about 1926 and are still plentiful.

Martin Shafer stated, in reference to the region between Chief Lake and Carp Lake, that only one wolf track was seen there in the winter of 1917 - 1918. During the following sixteen years tracks were seen occasionally; the animals became numerous about 1933 and continue to be so. Bands of 6 to 12, or their tracks, have been reported and in December, 1943, Shafer saw a band of 20, that later was joined by another ten, travelling along a frozen lake.

No wolves were in the Francois Lake - Ootsa Lake region in 1904, according to Jacob Henkel who settled there in that year. Twenty to thirty years ago a few tracks occasionally were found; wolves became plentiful there about 1932 - 1934 and have continued so.

C. D. Muirhead, who has lived in the Smithers - Telkwa region since 1929, reported that wolves were scarce until 1932; only at

TABLE VII

Bounties Paid on Timber Wolves in Central Interior British Columbia
1931 - 1942

Locality	1931	1934	1935	1936	1937	1938	1939	1940	1941	1942	Totals
Williams Lake	1	4	7	4	18	16	29	51	85	111	326
Quesnel	-	-	3	4	3	17	30	27	23	18	125
Barkerville	-	-	-	-	-	1	-	5	1	3	10
Prince George	20	21	36	62	96	138	354	269	277	298	1571
Fort Fraser	-	7	7	33	15	36	54	66	76	97	391
Smithers	3	7	11	4	17	13	34	25	21	18	153
Totals	24	39	64	107	149	221	501	443	483	545	

N. B. Bounties not paid in 1932 and 1933.

intervals were tracks, usualy of a single animal, seen and these always in outlying districts. The earliest report of larger numbers came in the winter of 1933 - 1934 when tracks of four in the snow at Houston Tommie Creek, ten miles south of its junction with the Morice River, were reported. In 1939 Muirhead saw tracks alongside the road between Topley and Topley Landing on Babine Lake. A complaint that a wolf population, estimated at 40, was preying on moose in the vicinity of Fort Babine became the subject of an investigation in the winter of 1940 - 1941. The investigation showed that the story originated in an Indian's observation of three wolves and the tracks of possibly three others. Furthermore, this investigation and later careful enquiries indicated that in the entire region from Takla Lake south to the Bulkley River, and west to the Skeena River, an area of approximately 3,500 square miles, the wolf population did not exceed 20. It is believed that at the present time, 1944, an estimate of 200 wolves for this area would not be excessive.

Evidence of an increasing wolf population is contained in Table VII, which shows the number of wolves submitted for bounty payment at five centres in the central interior, and at Williams Lake in the Cariboo Parklands, during the period 1931 - 1942 (see also Fig. 43).

Analysis of the tabulated data shows that 1939 was the peak year in central British Columbia. The figures for Williams Lake indicate a sustained southward expansion of the wolf population into the Cariboo cattle ranges. This was the southern limit of the invasion.

Mr. Muirhead believes that wolves invaded west central British Columbia from localities west of the coast mountain ranges, probably by way of the Nass River then south and east by the Skeena River. He believes also that a smaller number entered the south portion of this district by way of Gardiner Canal, the end of which is only 14 miles from Morice Lake. He suggest that the invasion may be explained as follows: It is the normal habit of timber wolves, as it is of many other animals, to follow the migrations of salmon up river from the coast. It also is their habit to retreat again to the coast in early winter, after the supply of spent salmon has been consumed. Until recent years there was not food of other kinds in sufficient quantities to hold wolves in the central interior. But when moose became established there and increased abundantly this new source of food altered the picture very much to the benefit of the wolves so that many remained and, under the stimulus of the plentiful food supply, populated central parts of the Province in a relatively short time.

No wolves were seen by me and on only one occasion was a wolf heard--this was at Francois Lake during the night. No kills or scats were found so that I can submit no first hand information on food habits The generally accepted belief is that moose constitute the main food item. This belief may be correct but it cannot be verified on the basis of observed data. Many reports of moose being killed by wolves have been received. Some perhaps are exaggerated, for example one that referred to 18 kills, said to be the work of 12 wolves, along a 21 mile stretch of river. It would be interesting to discover to what extent tick-impoverished moose are killed by wolves in spring, and if any of the reported kills are really instances of wolves feeding on the carcasses of animals which have died from disease.

There are also numerous accounts of wolf-predation on caribou. It might be expected that this form of pressure on caribou populations would be relieved because of the present abundance of moose.

Mr. J. B. Hooker told me he had found evidence, not once but numerous times, of wolves killing beaver along his trap line on the Torpy River.

Few accounts of wolf-predation on deer have been received, but this is held to have been responsible for a declining deer population along the Muskeg and Salmon Rivers. At Francois Lake in the latter part of July, two fresh kills of deer were found and the evidence clearly pointed to wolves as the predators.

There are many reports from farmers and stockmen of wolves destroying stock, chiefly foals and calves. It is suspected that where wolves are known to be in a locality all stock losses are charged to them, although it might be coyotes or bear which were responsible for the losses The small community along the north side of Francois Lake between Red Rock and Maclure River, a distance of 50 miles, lost 20 head of stock, chiefly calves, during May, June, and July, 1944 All these losses were attributed to wolves; it may have been correct to do so but in all instances the evidence was by no means conclusive Six ranchers and farmers in the Quesnel Game District reported cattle losses from wolf predation in 1943, to be 15 yearlings, or older, and four calves.

About May 1 an Indian at Fort MacLeod dug out a wolf den in which were five pups. Four of these, two black and two grey, were kept alive and taken to Summit Lake When I saw them there in late June, the body length of each was about two feet; the fur short and wooly They were gentle, playful animals and lived unconfined below a boathouse floor, from whence they would come when whistled for It was the intention of the owner to attempt training them for use as sledge dogs

The problem of the timber wolf and its relation to wild life and domestic stock is important enough to warrant careful

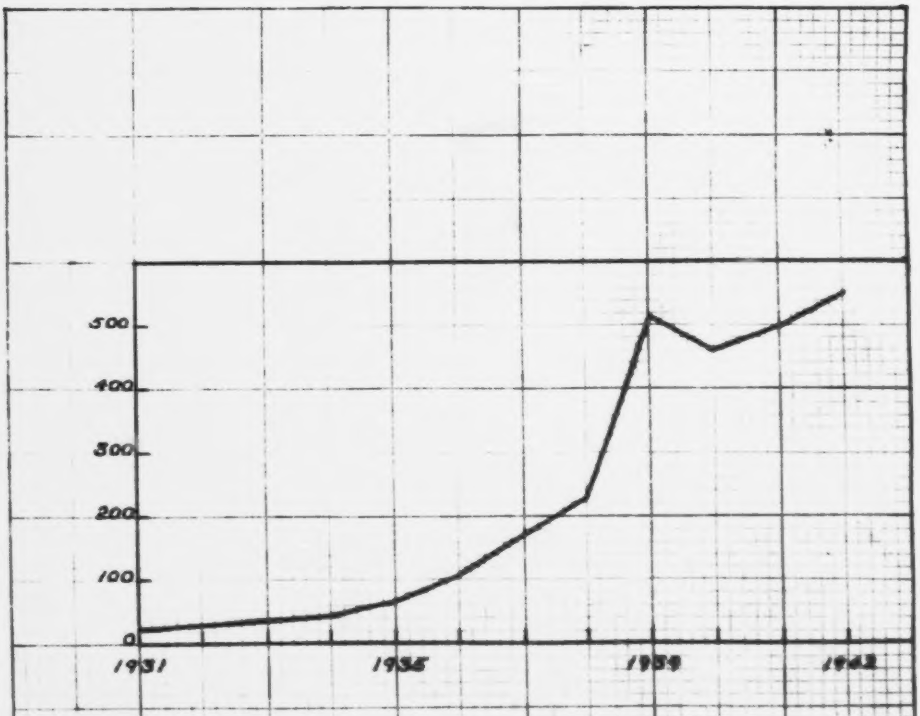


Fig.43 Graph illustrating increase of timber wolves in central British Columbia 1931-1942. Bounties not paid in 1932, 1933.

Fig. 43.

investigation. The picture as currently presented is clouded by elements of folklore, exaggeration, and error. The problem is a real one; it should be handled in a realistic manner through scientific research.

Canada Lynx--Lynx canadensis Kerr.

Fur royalty returns, available since 1921, show two peak years for Canada lynx in that time, viz.; 1926, 8,250 and 1935, 3,661. As might be expected the cycle here indicated coincides with that of the snowshoe rabbit, namely 9.7 years, the time-lag being about one year. It might also be expected that another peak would have been reached about 1944 but such has not been the case (Fig. 42). The lowest point reached after the 1935 peak was in 1939, 1,125. Following this the figures show a very slight increase.

1940--1,226
1941--1,295
1942--1,373
1943--1,520

This slow recovery may indicate that during the lean years special efforts were made to trap lynx because of the more attractive prices prevailing, and that the recuperative power of the species has not been sufficient to overcome this drain on a diminished breeding stock. However that may be the majority of trappers interviewed said that lynx had been scarce for several years. Marten Shafer reported a recent increase on his trap line, where none had been taken in 1939 - 1940, and nine and ten in the two following seasons respectively. He mentioned also that in 1917 - 1918 a total of 45 was trapped along the lower Salmon River and about Chief Lake, a territory south of his present trap line and one on which lynx are now exceedingly scarce.

Other information obtained is of some slight interest. In the Bulkley Valley only an occasional pelt is brought in, for example at Hazelton, six were purchased in 1941 - 1942, and two in 1942 - 1943. Farther east at Fort Babine and Old Fort Babine a total of 14 was purchased in 1942 - 1943. However these numbers probably do not represent the totals of lynx trapped in the areas served by these places for some pelts would be shipped out and sold elsewhere.

The number reported from the Quesnel Game District (see Table XIII) has been fairly constant in the past five years with a yearly average of 22.2.

TABLE VIII

Bounties Paid on Cougar in Central British Columbia
1933 - 1944

Locality	1931	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	Totals
Williams Lake	46	7	11	17	28	20	20	20	32	25	34	260
Quesnel	24	2	2	7	16	18	40	17	12	17	19	174
Barkerville	-	-	-	-	-	-	-	-	-	-	1	1
Prince George	10	7	3	2	10	5	14	12	17	6	18	104
Pouce Coupe	-	-	-	1	1	1	-	4	1	-	1	9
Fort Fraser	-	5	2	3	5	2	3	13	12	5	4	54
Smithers	3	2	5	4	2	3	1	4	2	1	2	29
Prince Rupert	8	1	1	4	3	-	2	2	11	3	3	38
Totals	91	24	24	38	65	49	80	72	87	57	82	

N. B. Bounties not paid in 1932.

Barred Bobcat--*Lynx fasciatus* Rafinesque.

The region is north of the range of the bobcat and only very occasionally is one recorded. The only records known to me are: one trapped by John Pauli near Strathnaver in 1942- 1943; one taken by a trapper named Boyd near Alexandria in 1943 - 1944 (these places are on the Fraser River, the first north, the second south of Quesnel). A third was trapped 10 miles east of Quesnel during the winter of 1944 - 1945. A short distance to the south in the Cariboo Parklands Biotic Area the species is common and hides frequently are sold at Williams Lake.

Cougar--*Felis oregonensis* Rafinesque.

The cougar is known to be more common in the vicinity of the Fraser River than elsewhere and this fact is apparent in the tabulation of bounties paid from 1931 to 1942 (Table VIII). It will be observed that Williams Lake, Quesnel and Prince George are centres of abundance, as indicated by bounty payments. The numbers diminish at points to the west in the Bulkley Valley and to the northeast at Pouce Coupe; none was paid at Telegraph Creek or Atlin.

The distribution of cougar parallels that of the mule deer--their chief prey. I received no reports of cougar-predation on caribou, moose, or goat, but that is not to say none occurs; cougar may be responsible for some of the predation attributed to wolves.

The numbers of cougar killed for the bounty does not vary greatly from year to year, a fact which indicates how ineffective is the bounty system of predator control.

Woodchuck--*Marmota monax* (Linnaeus).

This woodchuck has a wide distribution in lowlands and moderately high elevations but is nowhere common. Unlike the eastern form it is inconspicuous and rarely seen; one may approach fresh burrows many times without obtaining a glimpse of the animal which inhabits it. A number of woodsmen and ranchers with whom I talked had never seen a woodchuck in central British Columbia.

It is a shy and nearly silent animal that seems to spend more time below than above ground and its presence would usually escape detection were it not for the burrows, that are dug more often at the edge of a wood than elsewhere. At two places, viz.: Dragon Lake and Tiltzarone Lake, burrows were under buildings, and at Bouchie Lake a dozen or more were located in a field, which had been cleared of aspen, cottonwood and willow several years earlier, and in territory adjacent to it. The total area occupied approximated one-half square mile. Several burrow were under the fire-blackened stumps of cottonwoods, one was under a log pile, another in tall fern, two below the overhanging bank of a stream and several were in the open. Six of these undoubtedly were fresh and showed signs of recent occupation, but traps set at their entrances remained undisturbed, nor were any of the animals seen. It was observed her as in other localities, that no trail led from the burrow entrance, neither were there indications that any plants in the vicinity of the burrows had been eaten.

A burrow was dug out, at a place about 16 miles southeast of Quesnel, where a small group of Douglas fir stands in an aspen wood. The entrance to it (Fig. 45) was partly sheltered by, and in the centre of, four weathered prostrate firs which had fallen in such a way as to form a square. The soil was soft sandy loam. The burrow, four to five inches wide, slanted down to 18 inches then continued, at a lesser angle and in an almost straight line, back for nine feet. At the end, 36 inches below the surface of the ground, was a chamber not much larger than the burrow; this was lined with a small amount of dry grass. There was only one tunnel and one exit. No droppings were observed at the burrow entrance or elsewhere.

Other localities from which the animals were recorded on the basis of burrows examined or reports of animals seen are: Dale Lake, Nukko Lake, Burns Lake, Bulkley Lake and Kispiox Valley. A burrow at Nukko Lake was near the centre of a clover field. Martin Shafer told me he had seen woodchucks in his cabin clearings along the Muskeg River. At Tiltzarone Lake, on September 3, while examining the foundations of an old barn, I heard a sharp squeak, not unlike that made by a Columbian ground squirrel, and this led to the discovery of the entrance to a small burrow under the corner of the building. A trap set there that night had not been disturbed up to the following afternoon but a woodchuck was in it in the morning of September 5.

This specimen, and one other about half grown found dead on the Nazko Road two miles west of Quesnel, were the only woodchucks obtained. They are indistinguishable from topotypes of _Marmota_ _monax_ _petrensis_ Howell.

Specimens of the flea _Oropsylla_ _arctomys_ were collected from the woodchuck trapped at Tiltzarone Lake.

Hoary Marmot--Marmota caligata (Eschscholtz)

Hoary marmots were quite plentiful on the north slopes of Red Rose Basin, Rocher Deboule Mountains, where the population of adults was estimated to be 100. The animals were seen daily, sometimes five or six in view at one time, sunning themselves on the rocks scattered over the sloping alplands, or in swift movement across open pieces of ground. It was common to hear a number whistling in quick succession, and sometimes impossible to locate the source of the sounds. The animals were quite wary and difficult to approach. Apparently no predators were hunting them; there were no grizzly bear, on this part of the mountain at least, and neither golden eagles nor coyotes were seen.

Chipmunk--Eutamias amoenus (Allen).

Scarce in all localities. A female collected in Baker Creek Valley on May 10 was not pregnant; another taken there on May 14 contained five embryos. Only one other individual was observed during spring in that region but in late August approximately six young were recorded, on different dates, at Tiltzarone Lake.

None was seen at Bouchie Lake, in the Quesnel District, nor at Sixteen Mile Lake. One was observed on the road between Prince George and Chief Lake, July 3, and three on the road between Endako and Telkwa. It was scarce also on Rocher Deboule where only three were recorded during five days exploration.

Red Squirrel--Tamiasciurus hudsonicus (Erxleben).

Squirrels were not plentiful in the Baker Creek Valley in spring but by the end of August, when the full grown young were active, the population seemed fairly numerous. A trapper at Puntchesakut Lake spoke of a scarcity during the preceding winter when he was hunting them; he took only 15, while during the winter before he had obtained 50.

Squirrels were observed in all the localities visited, including the forests at timberline on Rocher Deboule. At no place were they plentiful. The price paid for squirrels in the season of 1943- 1944 was up to 55 cents. Taking into consideration the fact that a total of 2,201,364 squirrels have been shot or trapped in British Columbia in the past five years, it must be concluded that the species has remarkable recuperative powers.

What effect, if any, the removal of this large number has had upon the welfare of marten, believed to feed extensively on squirrels, can only be conjectured.

A tree nest at Puntchesakut Lake, ten feet from the ground in a small Engelmann spruce measuring 12 inches in diameter, was made of fine, dry grass and soft, desiccated alder bark.

In Baker Creek Valley squirrels were seen carrying Englemann spruce cones, and on the forest floor piles of spruce cone-scales marked long-used feeding places. A population at Bouchie Lake fed very largely on the seeds of Douglas fir and one squirrel was watched as it sat on a fence rail and rapidly stripped a cone. The cone was held lightly against the chest, and revolved against this surface by one front foot, while the animal rapidly bit off scale after scale; the other front foot was used to grasp and flip aside the detached scales. Those members seemed to have the tactile sensitiveness of hands, they moved so rapidly and with such precision. On the ground, in an aspen wood, close to one of sevaral old isolated Douglas fire, a deposit of scales covered approximately 120 square yards to a depth, in some places, of 12 inches. This probably was the accumulation of years; the scales at the bottom were decomposed and fell to pieces when touched. Whole cones were mixed amongst the debris and numerous excavations showed where some had been removed; through the mass and shading the feeding ground in summer, grew a few small service berries and hazels.

The subspecies represented is *Tamiasciurus hudsonicus columbiensis* Howell.

Fleas of the genus *Tarsopsylla* were collected from the nest referred to above and specimens of the fleas *Orchopeas caedens durus* (Jord.) and *Monopsyllus vison* (Bak.) were taken from squirrels trapped in the Baker Creek Valley.

Flying Squirrel--*Glaucomys sabrinus* (Shaw).

No flying squirrels were observed. Trappers operating in Baker Creek Valley, in the vicinity of Sixteen Mile Creek, at Summit Lake, along the Salmon and Muskeg Rivers and in Tweedsmuir Park told me that these animals are caught frequently enough to be considered a nuisance on the trap line. Two specimens were collected at Ootsa Lake, July 30 - 31, 1936, by McTaggart Cowan.

Beaver--Castor canadensis Kuhl

At one time beaver were abundant in all suitable localities, and the total of the yearly catch then as now provided the item of greatest value in the fur trade. At present over large areas the species is scarce or absent, a situation that has existed for some years. Figures of the numbers trapped prior to 1921 are not available. Since then Provincial Government records show that from July 1921 to 1943 royalties were collected on 405,805 pelts, taken in all parts of the Province. While this number undoubtedly does not represent the total of beaver trapped it can be taken as reasonably accurate. On this basis the largest number, 32,212, was taken in 1923; the smallest number, 10,826, in 1934. The number trapped in 1943, the last year for which records are availalbe, was 17,257 (Fig. 44). That the population has been maintained to the extent that these figures indicate would seem to be no mean achievement.

The system in operation since July, 1925, of allotting and registering trap lines so that trappers obtained security of tenure, would seem to be one factor that prevented a more serious decline in population numbers. Some, but by no means all, trappers have realized the possibilities of an increased and stabilized revenue that might be derived from a protected trap line. Such men have not only preserved breeding stock on their trap lines but have re-established beaver on trapped-out areas. Others, on the other hand, seem less inclined to profit by the opportunities thus afforded. They explain their attitude by stating, no doubt with some justification, that it has been impossible to prevent poaching on their lines, and as to this the Indian population, whether justly or not cannot be adjudged, is held by white trappers generally to be largely responsible.

It is understood that Provincial authorities propose to control the trapping of beaver by introducing a system of tagging pelts. Under this plan no beaver skin could be sold unless properly tagged and tags would be issued only to those trappers who had surplus beaver on their trap lines. Such a system to be effective involves census-taking and population studies by competent persons--an expense that, under the present condition of a declining population, is probably justified.

There has been and still is a movement to prohibit the trapping of beaver over a period of years. This plan is favoured by many stockmen, concerned with the restoration of water areas, and by some trappers, chiefly those who have not maintained a population of beaver on their trap lines. It is opposed by the fur trade and by those trappers who have successfully maintained beaver populations on their lines and are deriving an annual revenue from them.

The Baker Creek Valley is one of many areas in which beaver are now very scarce. There is none on any of the lakes, although old 'sign' is plentiful, and few are left on the creeks. At one time beaver were plentiful; a local trapper told me he trapped over 100 in one season about 20 years ago. The region is eminently suited to beaver production; Puntchesakut Lake where there is a large amount of aspen close to the shore has been populated in the past and would be a suitable place for re-stocking. Similar conditions also prevail farther west in the Nazko Valley. Successful introductions in this region and elsewhere, followed by carefully planned management over a period of years, might establish a local industry of importance both for Indians and whites.

Beaver are probably more amenable to management than any other fur-bearer. There does not seem to be any doubt that barren areas can be restocked and, under careful management, become a source of revenue within a relatively short time. The following is an account of a managed trap line in the Quesnel District.

In 1936 Dr. G. R. Baker, of Quesnel, registered a trap line comprising some 80 square miles between the Cottonwood and Quesnel Rivers; the approximate centre of the line being some 16 miles northeast of Quesnel. The area included three small lakes tributary to Cottonwood River, known as Edy, Sixteen Mile and Fifteen Mile Lake, and five small lakes and ponds tributary to Quesnel River. Both lake systems are connected by small streams and swamps and at one time had been productive beaver territory. For an undetermined period prior to 1936, possibly for 15 years, no indication of beaver had been seen there but in that year a pair of beaver entered the area and built a lodge at Edy Lake. It was this fact which prompted Dr. Baker to register the line, in the hope of establishing a population through protection. For the following five years the line was patrolled irregularly during the trapping season and, in spite of loss through poaching, an increase of the population became apparent. New lodges were observed on several lakes and in 1940 the population was estimated to be 35. The following year a trapper was employed to patrol the line regularly and to trap each season a small number of beaver. The total number taken by legal trapping in the succeeding years was 17, which was considered enough to provide funds sufficient to make the project self-supporting. The population, including adults and young, is estimated at the present time, 1944, to be not less than 65 and not more than 90. In addition to the population within the boundaries of the trap line new lodges, on territory adjacent to it, have been observed; for example, on the Quesnel River where beaver had been absent for some years. It is believed that these colonies are the result of a surplus overflow from the protected trap line.

In trapping the 17 beaver care was taken to make sets in places where large tracks were found; none was set within a half mile of a

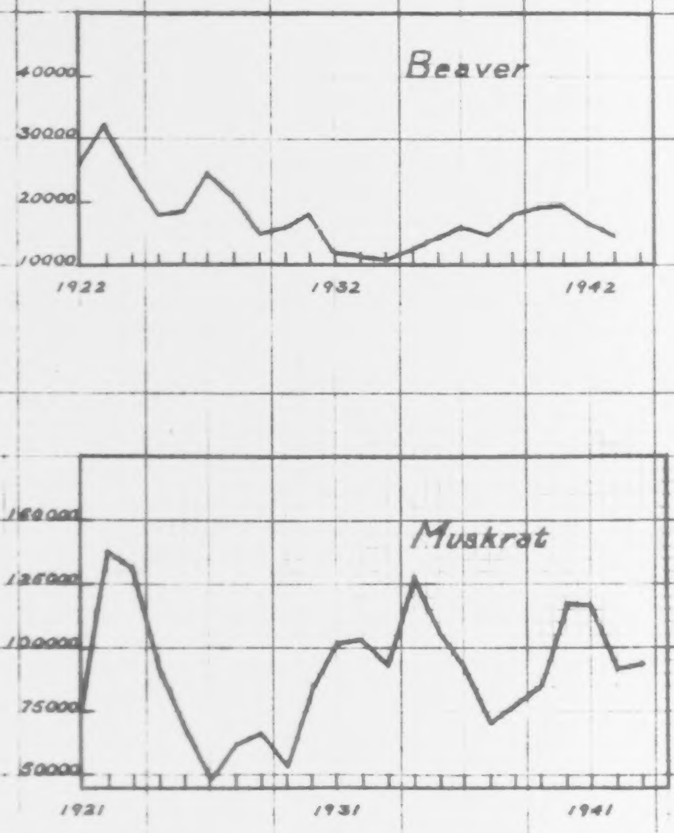


Fig. 44 Graphs illustrating fluctuations in catch of beaver 1922 to 1943 and muskrat 1921 to 1943. The trapping season for beaver was closed in 1921

Fig. 44.

lodge, no trapping was done at Edy Lake the place from whence came the original expansion of population, nor at the adjacent Sixteen Mile Lake. All the animals were adult males

In late August I was guided over parts of the trap line and in many places the presence of beaver was clearly apparent. The lakes were high; in several the heightened water level had killed the aspens and other deciduous growth on the shore, thus seriously reducing the food potential. At Fifteen Mile Lake were four occupied lodges; adjacent low-lying land as well as parts of an old wagon road were under water. There were two lodges on Sixteen Mile Lake and a very large one on Edy Lake. The population on Sixteen Mile Lake was estimated to be twelve The animals there had recently been feeding on yellow pond lily and detached leaves were found adrift and alongside the dam at the outlet. Beaver were seen swimming on this lake and the resounding report, as one slapped the water with its tail, and the loud splashings made when diving were common sounds in the night.

The origin of another colony at Dale Lake, referred to earlier is summarized here for convenience. In 1943 a pair of beaver dammed a small creek where it passes under an old earth dam made years ago by placer miners In the spring of 1944 the beaver added to the dam and as a result the creek quickly flooded the short, narrow valley through which it flows. Two lodges, one quite large (Fig. 46), were situated amongst the flooded aspens and willows, and evidence of beaver activity was visible on all sides. Later water backed farther into the valley and reached the meadow beyond, there creating a habitat suitable for waterfowl in a territory that formerly was dry. In June this flooded meadow was occupied by a fairly large duck population.

In this instance the potentials of an expanding beaver population, that under management might produce a satisfactory monetary return, and, in addition, a valuable waterfowl nesting area, were produced in little over a year's time.

Still another example of a small area being re-populated was studied on Nukko Creek, a stream that drains Chief Lake into the Salmon River. For the first mile or so below Chief Lake the stream winds through a boggy flat, then drops sharply into a rocky channel. Just above the decline is a beaver dam that recently had been added to; on the boggy shore of the creek near the outlet of the lake, a mile or less distant, was a medium-sized lodge and one of much smaller dimensions Numerous indications of beaver activity along the creek were observed. These animals, thought to comprise two adults and young, were being protected by the trapper whose line included the stream; the expectation being that the colony would increase in such favourable habitat

The foregoing are examples of beaver re-occupying trapped-out areas and no doubt this is taking place all the time Beaver are great travellers, constantly seeking new ground; time and again they will attempt to colonize a particularly attractive habitat--when a single animal or a pair is trapped, others eventually take their place. It would be desirable to protect these potential colonies until they become well established; this can be achieved through the work of the trappers themselves, and some are doing so as has been pointed out. Such intensive conservation will be greatly accelerated if and when a tagging system is successfully introduced, and the trapping of wandering beaver, which are potential colonizers, has been largely controlled.

Restocking barren areas by artificial means, that is, by the liberation of beaver, is another practical measure of conservation that has been done, on a relatively small scale, by the Provincial Game Branch.

The animals are captured in traps made of wire mesh on a steel frame, so constructed that both sides lie flat when the trap is set and spring upward when a trip on the bottom is released by a beaver passing over it. The following is an account of the procedure as followed by Game Warden E. Holmes in the Bowron Lake Game Reserve.

"First of all the best places to set traps are in sluggish streams or ponds where the beaver are very active, and where the water levels do not fluctuate to any extent. Places where beaver leave the water to forage for food on land are usually marked by well worn trails that slope gradually up from the water. These are very good locations for sets. The trap is set, on the bank or in a boat if one is used, then with the safety hooks in place it is carried to the selected spot and placed in not more than a foot of water as close as can be arranged to the shore approach. When the trap is in place, and secured with a short wire to a dry stake, the safety hooks are released and the set is ready. The trip used to spring the trap is a T-shaped affair made of stiff wire that stands upright in the centre of the trap and beneath a few inches of water; the rest of the trap is also well submerged. As the beaver travels over the trap, the T-shaped trip is pushed over, thus simultaneously releasing both sides of the trap. The trap is now standing upright, part of it far enough out of the water to prevent beaver from drowning. The trap is balanced in this position by the steel bar across the bottom which holds the jaws open. There are various places to make sets including dams across small streams, here some of the dam is removed and the trap set in the opening.

"Traps must not be left too long in one locality as too much disturbance might cause the whole colony to move to some other quieter place. If beavers are trap-wise, as they will get to be if nearby when others are caught, all traps are lifted and set in new locations. If the boss of the beaver colony is trap-shy it is time wasted trying to catch any around there, regardless of all baits or lures used. As beaver are most active during night traps should be examined early every morning."

Beaver are liberated usually in trapped-out areas and, while it has not been possible to follow the subsequent history of these introductions, it is understood that some have successfully re-established populations on limited areas. There is no reason to doubt that continued introductions on a scale designed to repopulate important watershed areas could be successfully accomplished. In places, such as the Okanagan Valley for example, where the conservation of water is essential to the welfare of an agricultural economy, considerable expenditure of funds for such ends would be justified.

An experiment in trapping and transplanting beaver in Utah produced 150 animals during July, August and September, 1940. These were sexed and tagged before being moved in crates to the points of liberation (7).

Experimental work in connection with the raising of beaver in captivity has been undertaken by some fur farmers but with what general measure of success is not known. The Provincial Government reports on fur farming operations show that in 1942 a total of 22 adults and young were in captivity.

Mr. J. L. Shelford, who operates a fur farm near Wistaria on Ootsa Lake, is conducting an experimental project on six acres of woodland which includes two artificial ponds fed by a diversion from a stream that dries out in summer. The operation was started in 1939 with one pair of beaver. In the interval none has escaped, so far as known, and none has been killed. Nevertheless, the population has increased to only six or seven; it has not been found possible to make an exact count. Mr. Shelford has considered the probability that two factors were responsible for this comparative lack of success, first that of a necessarily limited food supply and second a failure to remove any of the animals after an increase had taken place.

It has been necessary to enlarge the enclosure because nearly all the aspen within it has been eaten. In summer the beaver eat fire weed Epilobium, the aquatic vegetation that has become established in the ponds, and such vegetables as are put out for them. There are numerous beaten trails leading to what natural food is available. Since the ponds were constructed the beaver have added to and re-inforced the dams that now are substantial structures; they have built one large lodge near the centre of the larger pond (Fig. 47) and at least five small ones on the shore.

Incidentally it is worthy of note that a small waterfowl populations, that in 1944 included pied-billed grebe, mallard, green-winged teal, and buffle-head, has become established on these artificial ponds.

The open season for trapping beaver in central British Columbia is from March 1 to May 15 in each year. From the biological point of view the trapping of any animal in spring, when females are pregnant and the population, reduced by predation and winter food shortage, is at its lowest ebb, would seem an unsound practice. However, persons who are familiar with beaver habits maintain that spring trapping can be carried on to the benefit of the population by taking only the mature males. There are various methods designed to capture males only. One is to set traps a considerable distance from the dam and the lodges on feeding grounds where the signs indicate the presence of a large animal, which is usually a male.

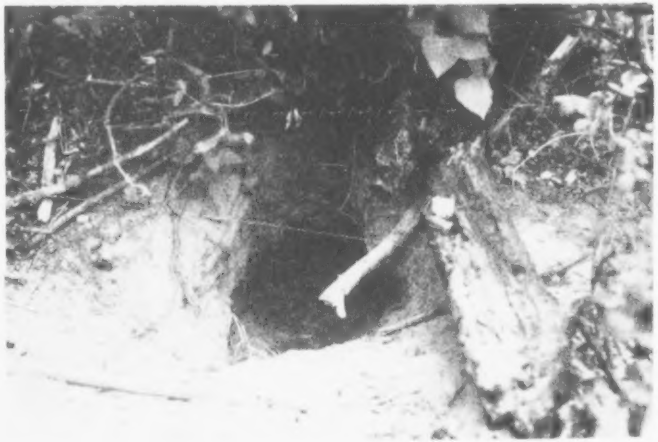
It is said that in spring gravid females drive out the adult and yearling males and these are the source from which the fur crop is taken by experienced, conservative trappers. Trapping in this selective manner, requiring a high degree of skill and knowledge, would represent an advanced form of management. How many trappers are sufficiently qualified, or sufficiently interested, to operate a trap line in this manner it is not possible to say

Wolves are said to prey upon young beaver and since the recent wolf invasion of central British Columbia the loss in some localities is reported to be substantial. Thus J. B. Hooker of Dome Creek told me that a portion of his trap line which he not trap for two seasons showed no increased in that time and this he attributed to wolf predation. He told me of finding numerous indications that young beaver had been eaten.

White-footed Mouse--Peromyscus maniculatus (Wagner).

Scarce in the Baker Creek Valley; more common at Bouchie Lake where nine adults and eight young were taken in 216 trap-nights. The habitats most frequented were dry aspen woods, and shaded willow and alder thickets near the lakeshore. It was relatively common at Sixteen Mile Lake, a total of 20 in 302 trap-nights being taken in deep woods and on the shores of two streams. None was trapped at Summit Lake in 183 trap-nights. At Nukko Lake a total of seven was trapped in 50 trap-nights, two being pregnant females (July 7), one a sub-adult male, and four, half-grown young. On Rocher Deboule, at about 4,500 feet altitude just below timberline, one adult male, two adult females and two young were taken in 90 trap-nights.

Nineteen adult and sub-adult specimens of Peromyscus maniculatus represent the following localities, viz.: Puntchesakut and Tiltzarone Lakes (Baker Creek Valley), 4; Bouchie Lake, 6; Sixteen Mile



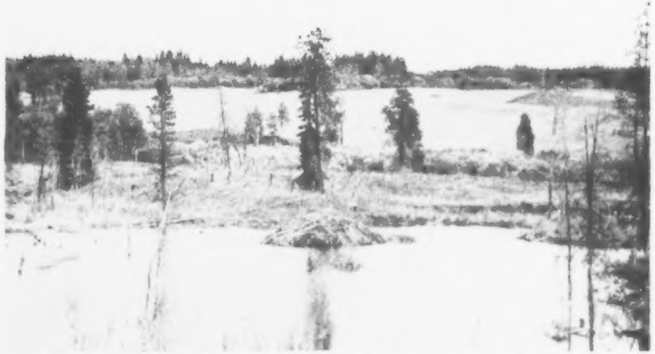
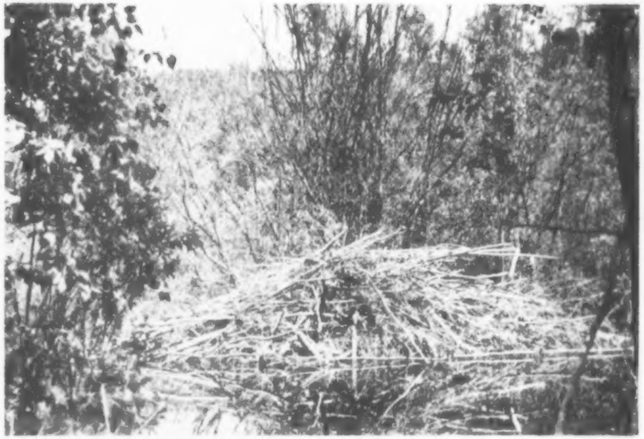


Fig. 45. Entrance to burrow of British Columbia woodchuck.

Fig. 47. Beaver house in artificial pond near Ootsa Lake.



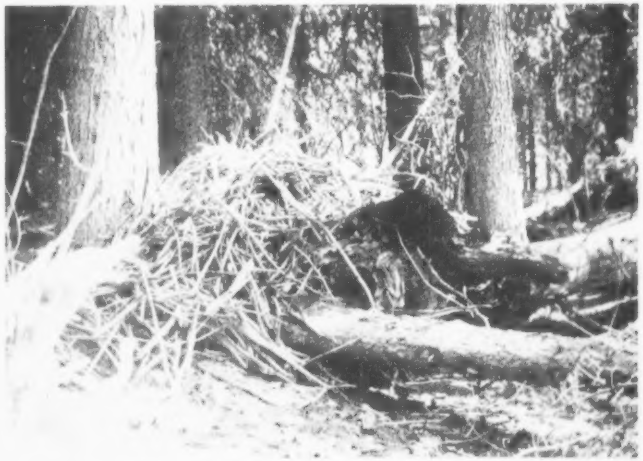


Fig. 46. Beaver house at Dale Lake.

Fig. 48. Woodrat's nest at Puntchesakut Lake.

Lake, 3; Nukko Lake, 3; Rocher Deboule, 3. It would be optimistic to attempt subspecific identifications from this small amount of material, however, the following comments, on size and colour only are included as being of some interest.

TABLE IX

Measurements of Sixteen Adult *Peromyscus maniculatus*

Locality	Number	Total Length	Tail Vertebrae	Hind Foot
Baker Creek Valley	4	171.25 (160-180)	85.75 (79-96)	20.25 (19-21)
Bouchie Lake	6	174.82 (163-180)	84.66 (75-90)	20.83 (20-22)
Sixteen Mile Lake	3	171.00 (161-180)	95.66 (83-110)	20.66 (20-21)
Nukko Lake	3	178.00 (165-187)	90.66 (81-99)	20.66 (20-21)
Rocher Deboule	3	193.33 (190-200)	106.66 (106-108)	21.33 (21-22)

The Baker Creek and Bouchie Lake specimens when compared with a larger series from the Cariboo Parklands are seen to closely parallel them in average length and average colour while the latter, in turn, in comparison with a series of *P. m. artemisiae* from the Okanagan Valley are noted to differ only in being slightly darker. This group then (from Baker Creek Valley and Bouchie Lake) can be regarded as nearest to the subspecies *P. m. artemisiae* (Rhoads). Three specimens from Sixteen Mile Lake are similar in colour but of greater average tail length than this subspecies.

Three specimens from Nukko Lake, some 80 air-line miles to the north of Baker Creek Valley, show modification in the direction of richer colouration--less grey and more reddish--and greater tail length. These are considered to be *P. m. borealis* (Mearns). The three Rocher Deboule specimens exemplify the well known tendency towards increased saturation and increased tail length (an alticline and colour-cline) exhibited by mountain population of *Peromycus* and which distinguishes them from populations inhabiting adjacent valleys. Increased foot length, also a feature of most mountain populations, is not a conspicuous character in these specimens. Examples of mountain populations accepted as valid subspecies are: P. m. oreas, P. m. macorhinus Rhoads and P. m. alpinus Cowan. The geographical ranges of these subspecies as recorded do not seem to include the mountain ranges east of the Coast Range in northern British Columbia of which Rocher Deboule is one.

Specimens of the flea Monopsyllus wagneri wagneri (Bak.) were collected on a white-footed mouse at Bouchie Lake.

Wood Rat--Neotomus cinerea (Ord).

At Tiltzarone Lake two unused cabins had been occupied by wood rats up to about May 3. In one an accumulation of material, taking up most of the space on a wide shelf on the wall, measured approximately 5' × 3' × 2'. It was composed of split and broken pieces of wood, some 12 inches long, the debris of a chopping block; a large amount of freshly cut branches of lodgepole pine with needles still green; paper; cloth and miscellaneous rubbish. In a corner of another room in this cabin was a similar accumulation of such material. Traps set for eight consecutive nights caught no rats and it seemed clear the animals had abandoned the cabin and taken up summer residence somewhere in the woods. On August 31 fresh droppings were found in the cabin and it was observed that strips of paper had been torn from the wall and added to the pile of rubbish on the floor. An adult female was trapped there on September 4, and another, about three-quarters grown, at Puntchesakut Lake on August 31.

Another heap, five feet in diameter at the base and nearly three feet in height, in an unused log school near Puntataenkut Lake was made entirely of chips. A trapper's cabin on Chief Lake contained the characteristic sign of long occupation by wood rats but no animals were there on July 7. This, like other cabins examined, had been used only in winter.

In a spruce wood, beside a stream that enters Puntchesakut Lake, a large nest made exclusively of dry and weathered spruce was built on the ground against a black spruce (Fig. 48). The nest measured 6 feet at its greatest diameter and four feet in height. At the base were several entrances and around it for a distance of six feet the ground had been tunnelled.

The two specimens collected are darker dorsally than two specimens in comparable pelage from Horse Lake, Cariboo, and darker still than the average of specimens from the Okanagan Valley. They are identified as Neotoma cinerea saxamans Osgood. A specimen of this subspecies collected at Stuart Lake is referred to by Goldman (3).

Specimens of the flea Orchopeas sexdentatus agilis (Roths.), were taken from the wood rat collected at Puntchesakut Lake.

Lemming Vole--Synaptomys borealis (Richardson).

A small female with four embryos was taken in a meadow vole runway at Puntchesakut Lake, May 15, and an adult male was trapped near the same place on May 28. A sub-adult male with enlarged testes, a sub-adult female and one young animal were taken between August 22 and August 24 at Sixteen Mile Lake. All were trapped in runways through Vaccinium which were used also by meadow voles and red-backed voles. On geographical grounds these specimens are ascribed to the subspecies S. b. dalli Merriam.

Tawny Lemming--Lemmus helvolus (Richardson).

Known to inhabit the mountains south of Ootsa Lake in Tweedsmuir Park, where specimens were taken by John Shelford for the British Columbia Provincial Museum.

Phenacomys--Phenacomys intermedius Merriam.

A single specimen was trapped in a grass patch on an unused road, within a few yards of a small stream, at Sixteen Mile Lake. This set subsequently captured only meadow voles and red-backed voles.

On the heather-covered alplands of the Red Rose Basin were several small areas where faintly marked runways led through the vegetation to burrows under the adjacent rocks. None was fresh and no sign of recent occupation was observed. These probably represented the work of Phenacomys colonies.

Red-backed Vole--*Clethrionomys gapperi* (Vigors).

The habitat of this vole is much more definitely restricted than is that of the meadow vole *Microtus pennsylvanicus* and in this observer's experience the animal has not been found outside of forested areas and their immediately adjacent grasslands. The meadow vole on the other hand, during periods of rapid population expansion, invades woodland habitat and competes with the red-backed vole. This was so at Sixteen Mile Lake where both species were at the peak of abundance and enormously plentiful in a heavily wooded region. Twenty-nine red-backed voles were taken there in 36 traps during a 24-hour period, and a total of 90 in 302 trap-nights. Thirty-three were adults and sub-adults and 57 were young of various ages. The animals were active at all hours and about the same proportion was taken during the day as was taken at night. They were most common about fallen logs, under tree stumps and in patches of kinnikinnick, but *Microtus* runways through grass patches were used and a number of specimens were taken on the shore of a small creek. None of the females taken in August was pregnant. One photograph was obtained (Fig. 49).

At Puntchesakut Lake, Baker Creek Valley, the only habitat occupied was dry aspen and lodgepole pine forests where specimens were trapped in runways through moss and kinnikinnick and at burrow entrances at the bases of aspen stumps. One female trapped, May 14, was pregnant.

At Summit Lake it was common along a heavily wooded shore; runways were alongside fallen logs, under stumps and through shrubbery. Ten adults and sub-adults and seven young of various ages were trapped. None was pregnant. One specimen had an engorged tick *Ixodes angustus* attached to the head.

At Nukko Lake a female carrying three large embryos was trapped on July 8.

The subspecies represented is *Clethrionomys gapperi saturatus* Rhoads.

Meadow Vole--*Microtus pennsylvanicus* (Ord).

At Puntchesakut Lake and Tiltzarone Lake in Baker Creek Valley this meadow vole was fairly common in large sedge meadows; populations were pretty well confined to such places. Small grassy areas in the forest contained no voles and few were in the muskegs--habitats that are overrun when a population is nearing a peak and expanding in space.

The centre of abundance for one population was a small willow thicket on a meadow knoll where most of the willows were dead and brittle, with long grass growing amongst them. Here were many runways, throughout the thicket and the sedge-covered ground surrounding it, and numerous burrows led under the roots of the dead willows. Willow bark had been eaten during the winter and a few willow shoots had been denuded for a distance of eight inches above the ground; others, about 1/8 to 3/16 inches in diameter, had been cut into lengths of six to eight inches. Several piles of these lay on the ground and single shoots protruded from burrow entrances.

These meadows were not occupied to anything like full capacity. Along the margin of one meadow, where grass had grown thickly amongst small dwarf birch and willow, were networks of old runways. These had long been abandoned and held no fresh sign.

Twenty-eight adults and three young were captured in this habitat in 496 trap-nights, May 12 - June 3. Two trapped on May 28 were nursing females; the first young, measuring 80 mm., appeared on May 29. In early September three large young were taken in 24 trap-nights.

The populations at Bouchie Lake were larger and showed indications of expansion. Some animals were trapped in old deeply worn runways on rough ground amongst tree stumps, tall grass and other vegetation, others on the shores of Bouchie Creek--one at the entrance of a burrow eight inches above water in the steep bank--and a dense population centred about a narrow strip of territory between the margin of an aspen wood and a boggy sedge marsh. Eighteen adults and sub-adults and 11 young were taken in 261 trap-nights, June 16-18.

At Sixteen Mile Lake, on the east side of the Fraser River, 16 miles east of Quesnel, a region of heavy coniferous forest, the species had reached the peak of abundance. Nearly every grass patch in old clearings was marked by worn runways; other runways led under brush heaps, log piles, stacked wood and an occupied log cabin. In addition to being trapped in runways the voles were taken in deep, mossy woods, along streams, under uprooted trees and beside mossy logs. The animals seemed to be everywhere and traps set in the open were likely to be as effective as those set in runways. Forty-four adults and sub-adults and 42 young were taken in 302 trap-nights.

The species was not common at Summit Lake, another heavily forested region. A small boggy area at the edge of a clearing beside the lake, where black twin-berry, horsetail, skunk cabbage and sedges made dense shade, contained several runway systems but trapping here for five days and nights produced only two specimens, a sub-adult male and an adult female carrying six large embryos. Other systems of runways through sphagnum and in thickets of dwarf birch in a muskeg produced two more specimens, an adult and a sub-adult male, in 36 trap-nights.

At Nukko Lake a small population inhabited an area grown up with shrubbery and grass which surrounded a small cultivated field in the forest. Runways led through brush heaps and grass patches, and burrows led under aspen stumps. Six specimens were taken.

One sub-adult male was trapped on Rocher Deboule at about 4,500 feet altitude in a thick growth of sedges and cow parsnip.

The subspecies inhabiting central British Columbia is M. p. drummondi (Audubon and Bachman) (6)

In all colonies could be observed individual variations in colour of fur, on both dorsal and ventral surfaces, colour of feet, texture of fur and tail length. This was observable to an appreciable degree in newly emerged young as well as in adults. In adults the condition of moult was a factor in this differentiation but undoubtedly other factors are involved. A series of nine adults from Puntchesakut Lake taken in May vary on the dorsal surface from pale to dark--nearest to Ridgway's Drab and Olive Brown. The tail length ranges from 38 to 45 mm. A series of five specimens from Bouchie Lake taken in June vary in colour from rusty-red to dark brown--nearest to Ridgway's Saccardo Umber and Sepia. The tail length ranges from 45 to 54 mm. A series of six from Sixteen Mile Lake taken in August are similar to Bouchie Lake specimens. The tail length ranges from 44 to 56 mm. Two from Summit Lake trapped in wet, shaded bog had sleek, shiny brown pelage and dark coloured feet. Two trapped in open muskeg had rough, grey pelage and light coloured feet, and two from Nukko Lake are nearest in colour to Brussels Brown; one has the lower surface suffused with brown.

In some young the pelage is rusty-brown, the feet pale; in others the pelage is dark brown, the feet blackish. One large young from Sixteen Mile Lake is nearest to Drab on the dorsal surface, brightening to Tawny Olive on the head; the belly is suffused with Pinkish Buff

TABLE X

Measurements of Twenty-four Adult Microtus pennsylvanicus

Locality	Number	Total Length	Tail Vertebrae	Hind Foot
Puntchesakut Lake	9	150.77 (147-157)	40.55 (38-45)	18.55 (18-19)
Bouchie Lake	5	167.20 (162-172)	49.00 (45-54)	18.40 (18-19)
Sixteen Mile Lake	6	162.00 (153-178)	48.16 (44-56)	19.00 (19-19)
Summit Lake	2	150.30 (140-163)	43.50 (39-48)	19.50 (19-20)
Nukko Lake	2	161.50 (161-162)	53.00 (52-54)	19.50 (19-20)

Long-tailed Meadow Vole--Microtus mordax (Merriam).

Found only in the Red Rose Basin, Rocher Deboule, where an adult male was trapped on July 21 and a female with five embryos on July 22. The set which captured these two specimens was under the matted branches of a procumbent alpine fir growing beside a small stream. These specimens are slightly darker than the average of specimens from the Okanagan Valley, the East Kootenay and Glacier. The male has the ventral surface suffused with a brownish shade. In reference to six specimens collected on Nine Mile Mountain, which is situated across the Skeena River from Rocher Deboule, Swarth states these "apparently illustrate intergradation between mordax of the interior and macrurus of the Coast (9). This conclusion would seem to apply also the specimens from Rocher Deboule.

Muskrat--Ondatra zibethicus (Linnaeus).

The muskrat is widely distributed, inhabiting all suitable waters on low and moderately high elevations. It is an important item in the fur trade and represents a large proportion of the catch taken by many part time trappers. The fur returns show a marked cyclic pattern (Fig. 44).

At no place in Central British Columbia were water conditions so favourable for muskrat production as are some waters in southern

British Columbia. The waters vary in the elements making up the food potential and some could be classified as sub-marginal. The details of observation in different localities are submitted separately. Full descriptions of the lakes referred to are included in my report on ornithological observations.

Puntchesakut Lake: This lake contains a number of small shoreward marshes composed chiefly of sedges. The population is small; one trapper took a total of 34 during the spring trapping in 1944. On a floating feeding place the sedge Carex rostrata had been eaten, and in several places on shore were leaves of yellow pond lily which had been cut off by muskrats. The only house found was composed of sedges and mud.

Tiltzarone Lake: Several houses with surface diameters of two to three feet were composed of sedges, horsetail, water moss and mud. The population is small.

Both these lakes are marginal territory. Probably the successful introduction of round-stem bulrush, now entirely absent, would improve the situation. With improvement of habitat and under careful management the fur yield undoubtedly could be increased substantially.

Puntataenkut Creek and Expansion: Numerous houses here, made of horsetail and mud, indicated a relatively large population. By May 31 most of them had disintegrated and were largely absorbed in the marl of the lake bottom. Food in the form of sedge and horsetail was much more abundant than in the lakes noted above.

Bouchie Lake: Here cattail is the chief material used in the construction of houses; one made entirely of round-stem bulrush was an exception. The round-stem bulrush Scirpus acutus is the principal summer food eaten. The muskrats build their houses in the cattail marshes; the feeding places were located there and the majority of them held partly eaten bulrush stems. At one place the soft, lower parts of cattail had been eaten. Along the shore of Bouchie Creek a muskrat had cut down and eaten several plants of horsetail.

The population at present is small, under careful management it could be greatly increased.

Milburn Lake: This has been a good muskrat lake; it contains food, including round-stem bulrush, sufficient for a relatively large population. At one time part of the marsh was enclosed by a close picket fence, with the object of 'farming' muskrats. Apparently this venture was not successful. Two old houses were found but there were no signs of recent activity, and no muskrats were seen. It would appear that the population has been greatly reduced in number.

Dragon Lake: This should be a good muskrat lake Along its 10 miles or so of shoreline are numerous round-stem bulrush marshes ensuring a plentiful supply of summer food. However, the population was quite small and only three houses were observed; these were quite old and broken down.

Summit Lake: The several sheltered bays of this lake provide marginal territory for muskrats The food resources include horsetail, sedges of various species, buckbean, Potamogetons and a large mussel; along shore shell heaps marked the places where mussels had been eaten by muskrats.

Nukko Lake: Numerous marshes of round-stem bulrush, cattail and horsetail provide sufficient food and house material for a fairly large population of muskrats. Mussels are abundant, and numerous places where these had been eaten were noted Round-stem bulrush seemed to be the favourite summer food, as indicated by the debris on feeding places One large house made of round stem bulrush was examined.

Salmon and Muskeg Rivers: According to Martin Shafer the chief habitat for muskrats along these rivers, as it is in many other northern localities, is the beaver dams. Here the muskrat population has declined as the beaver population declined. In 1944 Shafer took only 60 rats along his 60 miles of trap line.

Maclure Lake: This lake, with its relatively large round stem bulrush marshes and extensive beds of submerged vegetation for winter feeding, is capable of supporting a muskrat population of considerable proportions. One substantial house built of cattails, and numerous places where round-stem bulrush had been dragged on to feeding places, were examined

Bulkley Lake: Muskrats were scarce here and the only indications of their presence were the shell heaps where mussels had been eaten

Toboggan Lake: A small population inhabited this glacier fed lake. The only house examined was made of horsetail; this had disintegrated to a small heap of debris. A fallen log 30 feet long that lay in a sedge marsh was used as a feeding place and here stalks of the sedge Carex rostrata had been eaten

Trapping: The trapping season in central British Columbia is from March 1 to May 15 in any year. Spring trapping of breeding muskrats would appear to be an adverse factor in the maintenance of adequate populations. It is not claimed that selective trapping can be accomplished as is possible in connection with beaver According to some trappers the objections to fall and winter trapping are: the fur is said not be prime; a number of small 'kits' are taken; winter trapping near houses or at 'pushups' results in extra loss of animals through the freezing of these places.

House Mouse--Mus musculus Linnaeus.

Apparently this species has not reached the Baker Creek Valley where only the white-footed mouse was trapped in and about dwellings. One house mouse was trapped at Bouchie Lake and another at Francois Lake. No doubt it is established in all the older settlements.

Hudson Bay Jumping Mouse--Zapus hudsonius (Zimmerman).

Two specimens were trapped at Bouchie Lake and one at Summit Lake. This species and the Rocky Mountain jumping mouse frequent the same types of habitat.

Rocky Mountain Jumping Mouse--Zapus princeps Allen.

Moderately common in all localities. Stream sides proved to be good trapping ground but almost every kind of habitat produced some specimens. The material collected suggests that two subspecies are represented, viz.; Z. p. kootenayensis Anderson in the Bouchie Lake - Quesnel region and Z. p. saltator Allen at Nukko Lake and Rocher Deboule.

Porcupine--Erethizon epixanthum Brandt.

Single porcupines were seen at the following places: Tiltzarone Lake, May 7, September 3; Puntchesakut Lake, May 3, September 1; Goose Lake, May 20; Bouchie Lake, June 15; near Vanderhoof, August 15.

At Bouchie Lake one or more porcupines had been feeding on new raspberry canes in a small garden surrounded on two sides by aspens and I counted 24 canes that had been eaten down close to the ground. At this place an unusually light coloured animal that visited the veranda of an occupied cabin at night had to be forcibly ejected. Near Tiltzarone Lake, September 3, a porcupine, feeding on rose hips along a forest trail, stood upright in order to reach the fruits high on the bush. It was so engrossed by this occupation that I was able to approach, apparently unseen, within five yards. When my presence was detected the animal shuffled down the road for some distance then made off into the woods

At Nukko Lake one or more lived in a small cellar under an unused cabin where signs of continued occupation were conspicuous on the earth floor.

Pika--Ochotona princeps (Richardson).

Reported to be established on Seven Sisters Mountain, according to Mr E S Fordiffe, Doreen, B. C., and on the mountains north of Moricetown where they were observed by a Moricetown Indian, Jimmie Michel Both these records of observation were submitted by Mr. C. D Muirhead

Snowshoe rabbit--Lepus americanus Erxleben

Snowshoe rabbits were fairly plentiful on both sides of the Fraser River in the vicinity of Quesnel. In reference to this locality, Cowan has stated (1): "In 1932 .... in 4 miles along the Cariboo Highway a few miles north of Quesnel I counted upwards of 150 rabbits feeding on the edge of the road, and these conditions obtained throughout the entire northern section of the Province. Two years later, in the same district, not a rabbit was to be seen. Four years later a week's trapping produced but four individuals." From this account it may be inferred that since 1932 the cycle from abundance to scarcity has made one complete revolution and that in 1944 the rabbit population, in the Quesnel region, was on the upswing of another cycle.

Rabbits were relatively common also in the vicinity of Prince George, and northwest to Nukko Lake and Chief Lake, in the same type of rich woodland habitat that prevails about Quesnel In the dry uplands and willow swamps of Baker Creek Valley, Francois Lake and Bulkley Lake the animals were scarce In the Baker Creek region only three were seen during a month in spring; there was little sign of recent occupation on the bare forest floor and a few barked, prostrate aspen was the only evidence of the previous winter's feeding Only one was recorded there during a week of early autumn spent mostly in the woods. None was seen at Francois Lake nor at Bulkley Lake; at both these places the woods seemed devoid of rabbits and there was little sign Several were recorded along the road between Francois Lake and Ootsa Lake but nowhere west of Prince George were rabbits noted as common.

The first young was seen in Baker Creek Valley (Puntchesakut Lake) on May 29; another recorded on June 4 was about half-grown. In the Quesnel District young were seen much more often, chiefly feeding along the roads; one was photographed in a wooded area near Dragon Lake on June 20 (Fig 50).

A nursing female, shot at Puntchesakut Lake on May 6, had 22 ticks Haemaphysalis leporis-palustris on the head; 12 were engorged. This animal was in good condition so far as could be judged; no parasites were observed in the muscle tissue and the internal organs seemed normal Another found dead by the roadside on May 16 had an equal number of ticks about the head. This specimen was not dissected.

Two specimens collected are representative of the race Lepus americanus pallidus Cowan.

Wapiti--Cervus canadensis (Erxleben).

On October 6, 1931, an Indian named Duncan Donal George killed a male wapiti on Chilco Creek about eight miles east of Vanderhoof. This animal was confiscated by the authorities and the mounted head is reported to be in the Elks Hall at Prince George. This appears to be the only precise record for the region. Several sight records, one in reference to animals seen east of Houston in 1944, are not authenticated

Mule Deer--Odocoileus hemionus Rafinesque.

The benches and slopes along the Fraser River in the vicinity of Quesnel, where the snow does not lie deep at any time and disappears earliest in spring, is a winter range for mule deer On the east side of the river this range extends eastward at least to Sixteen Mile Lake, where Carl Carlsen counted seven in one band in February, 1942. The region along the Fraser supports a summer population also and does have their fawns in the thickets along the river bottom. On June 23 a doe, accompanied by a fawn about three weeks old, crossed the road near Cottonwood Creek About a mile north of this place a doe with a newly born fawn was observed. The fawn ran about 20 yards then squatted on the grass by the roadside while the doe remained close by in the brush.

In the Baker Creek Valley, which is reported to be a summer range only, the first track was seen on May 21 After that tracks were plentiful and the animals were seen regularly. One old doe in winter pelage was watched for several minutes on May 31 as she stood half-concealed amongst shrubbery.

The only other place where a deer was seen was near Houston; there a four-point buck ran alongside the road for several hundred yards. Tracks were found in most of the localities visited. Martin Shafer told me that the Salmon and Muskeg River region formerly were used in both summer and winter but this is now summer range only. The population there is reported to be declining a condition attributed to wolf predation. The mountains on the south side of Carp Lake are mentioned as a former winter range.

The deer population is reported to be increasing in the Ootsa Lake region. In the vicinity of Smithers the animals are said to be generally distributed on the surrounding mountains in summer and on the lower slopes and the valleys in winter.

Moose--Alces americana (Clinton)

The invasion of central British Columbia by moose, about which much has been written, apparently commenced some 50 to 60 years ago. Since then extensive regions have been populated and the invasion has penetrated as far south as the vicinity of Kamloops; as far west as Kitimat, which is on the Granville channel about 40 miles southwest of Terrace, and for an undetermined distance north. As with other animal invasions, or successful introductions, moose increased slowly at first, then, in the more favourable localities, with an acceleration that produced over stocking of range and a subsequent decline to a condition approaching a balanced population.

There is, of course, difference of opinion amongst local residents regarding the date of the first appearance of moose in any region. In each district visited I made a point of calling on the person reputed to be, amongst the older residents, the one most reliable in the matter of accuracy. Amongst other questions asked was one relating to the first local record for the appearance of moose. The answers, arranged in accordance with the geographical position of the locality, and roughly from east to west, are presented in Table XI.

So far as I am aware there is no evidence indicating that similar invasions occurred in a remote past. Certainly there were no moose in these regions at the time of the early explorations during the last decade of the eighteenth century, and no records prior to that time are available. No factual explanation has been offered to identify the factors which put into motion, or continued to impel, this movement. The question has often been the subject of debate and various conjectures, such as the reduction of Indian population to the northeast, the decrease of predators in one locality, or the increase of predators in another, and the building of the railway to Prince Rupert, have been offered in explanation of this remarkable invasion.

TABLE XI

First Records of Moose from East to West

Locality	Authority	Year
Barkerville	H. Boyd	1906
Cottonwood	"	1911
Quesnel	Mrs.W. Dale	1915
Baker Creek Valley	J. Quanstrom	1915
Muskeg & Salmon Rivers	Martin Shafer	1917
Nukko Lake	Andrew Allan	1910
Vanderhoof	A. Rae	1919
Endako	Ernest Hedren	1920
Francois Lake	Jacob Henkel	1905
Houston	J. Preece	1922
Telkwa	C. D. Muirhead	1922-24
Clore River	"	1931
Kitimat	"	1940

Further details concerning the past and present status of populations, as reported by some of the persons listed in the foregoing tabulation, are of sufficient interest for inclusion in this report.

In the Baker Creek Valley, where moose were first seen in 1915, the population reached fairly large proportions between 1925 and 1930. Since that time it has increased greatly and the district is now considered to be one of the exceptionally good hunting territories.

In the autumn of 1943 a total of 23 bulls was shot by the hunters at one camp alone. The area is both summer and winter range; according to one observer about half the population moves eastward in early winter to the Fraser River Valley and other valleys where there is less snow. However, the residual winter population is relatively large and the animals are then much more in evidence than at other times. For several months in the winter of 1943-44 four bulls fed at a haystack near Tiltzarone Lake, and two of them shed their horns there. The Bouchie Lake region supports a large winter population as could be seen by the quantity of winter droppings and other signs.

Mr. J. B. Hooker of Dome Creek told me that moose increased up to 1933, which was the year of greatest abundance; after that the numbers declined, but the population is still relatively large.

Mr. Martin Shafer reported that the population along the Salmon River, Muskeg River and part of Carp Lake gradually increased in numbers after 1917 and the animals have been abundant for the past 10 years or so.

Mr. Jacob Henkel, who settled near Francois Lake in 1904, told me that the first moose were killed in that region in 1905. In that year an Indian named Batiste, who is still alive, shot two beside a small lake south of Francois Lake and gave some of the meat to Henkel.

Moose were first reported from the Smithers region between 1922 and 1924; the population reached a peak in numbers about 1935. A local decline, first noted in 1939, has been attributed to wolf predation. However, the animals are still plentiful and an unusually large calf crop in 1944 suggests that an increase is again in progress. About three miles south of Telkwa is the northern fringe of an important summer range for cows and calves; this consists of a series of beaver meadows and wet slopes covered with dogwood.

General Life History Observations: In spring there is a general movement of mature bulls from the valleys to the higher slopes and remote muskegs, so that most of the animals seen during the summer are cows, calves and yearlings. Cows sometimes exhibit great concern for the young calves; this was so with one near Puntataenkut Creek, May 31, that had her calf concealed on a grassy bog while she fed along an adjacent hillside. When this animal saw my canoe, conspicuous in the small creek that winds through the bog, in close proximity to the calf, she rushed downhill towards it, snorting and blowing as she did so. Finally both cow and calf slipped away through a willow thicket and were not seen again.

Moose usually seem able to travel over floating bog and deep marsh that a man would find difficult or impossible to navigate.

Nevertheless there are many reported instances of moose becoming bogged down with fatal results. For example near Puntchesakut Lake, it is not uncommon to see moose struggling to extricate themselves from deep boggy holes; some, that have not succeeded in doing so, die from exhaustion and eventual suffocation. In one instance a young bull was roped and pulled out of one of these holes. The worst places have since been fenced but even so moose still are attracted and break down the fences in getting to them.

Food: Near Tiltzarone Lake I examined and photographed several groves of small aspen, averaging about 10 feet in height, which had been browsed during the preceding winter (Fig. 51). Many of the trees were broken off about six feet from the ground. It was noted later in the summer that few had leafed out and many were dead. Most of the trees in other similar groves, browsed several years earlier, also were dead. Other browse used here were black twin-berry, willow, and the terminal branches of small lodgepole pine. About five acres of low willows on a meadow close to Puntchesakut Lake had been heavily browsed; the dry grass in the meadow also had been eaten. The amount of winter droppings indicated constant use of the meadow over a long period.

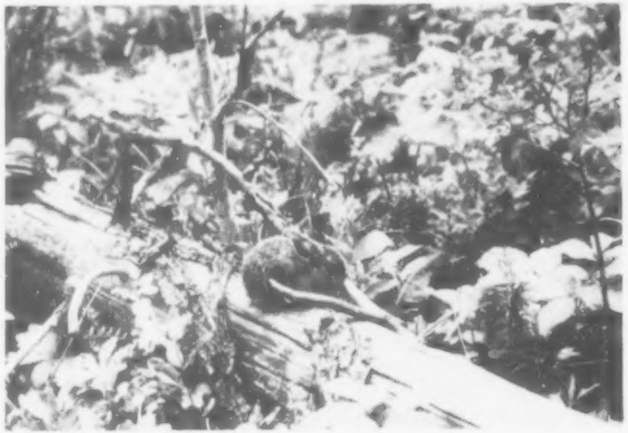
At Bouchie Lake young aspen groves winter browsed by moose, and dead from this cause, were found on some of the side hill slopes. Here also aspen 10 to 12 inches in diameter were stripped of bark for a height of six feet above ground.

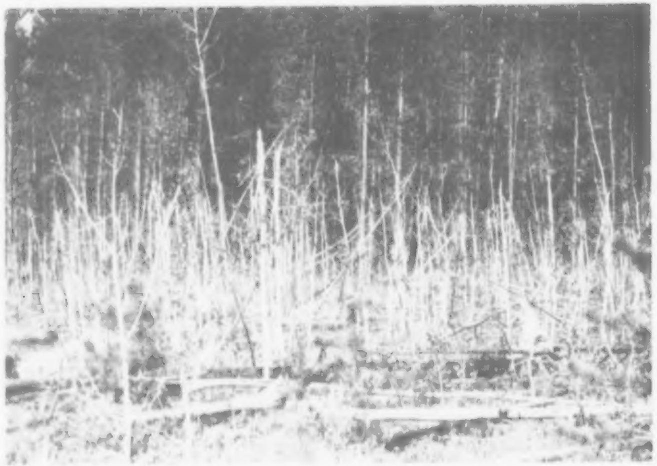
At Summit Lake, where aspen is relatively scarce, mountain birch and mountain ash were browsed. A large bed of buckbean, which had been under observation, was completely eaten down during the course of one night. In this heavily forested country moose were less abundant than on more open terrain.

At Swamp Lake the surrounding muskeg was criss-crossed with deep trails, and along the creek that drains the lake, willows had been heavily browsed during the winter months.

At Nukko Lake horsetail is the dominant growth in some marshes; there were many places where this plant, growing in two or three feet of water, had been eaten by moose.

Restrictive Factors: More moose than any other of the horned game animals, with the exception of deer, are killed each year in British Columbia. A record of the annual kill is not kept and it is not known what percentage of hunters licensed to take big game actually hunt moose. The number of licenses to hunt big game issued in 1942 was 6,119. The only basis for an estimate of the annual kill are the reports of the numbers killed by non-resident hunters and the numbers reported killed by licensed trappers. In 1942 the number of moose reported killed by 511 persons in the first category and 1,986 persons in the second





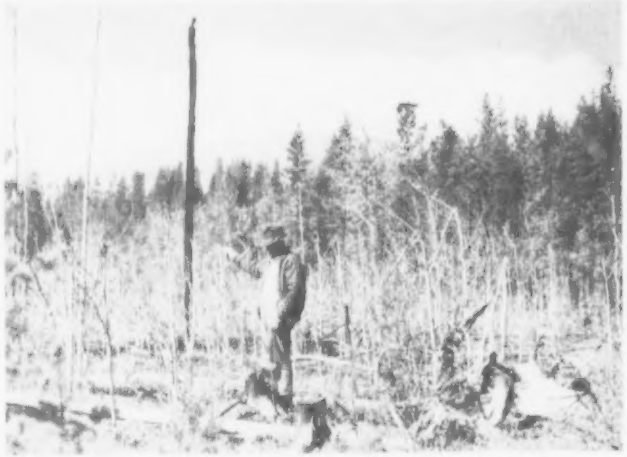


Fig. 49. Red-backed Mouse. Sixteen Mile Lake.

Fig. 50. Young Snowshoe Rabbit, Dragon Lake.

Figs. 51 and 52. Aspen at Puntchesakut Lake browsed by moose in winter.

category was 716. This works out roughly to one moose for every 3.4 hunters. On this basis the number of moose killed by all of the 6,119 persons licensed to do so would be 1,799. To this figure must be added the unknown number killed for food by settlers and Indians. Possibly the annual kill approximates 3,000. Whatever the size of the annual kill may be there is no reason to believe it has not been within the recuperative capacity of the species to tolerate, for populations generally are being maintained, and some expansion in space is still going on.

The above speculation as to the size of the animal kill may be wide of the mark. It is submitted in order to draw attention to the need for population counts and for annual records of the number of moose killed.

That wolves prey upon moose seems to be an undisputed fact, and there are reports that local moose populations have been reduced by wolf predation. The general opinion in central British Columbia, as in other regions where similar conditions prevail, is that the wolf-moose relationship is entirely detrimental to the latter, but, needless to say, a contrary conclusion can be drawn. In recent years wolf-predation very likely has been a factor in the range expansion of the moose.

Each year a number of moose are found dead apparently from disease. The carcasses are described as being very thin and in some instances show suppurating sores; nearly all are infested with the tick Dermacentor albipictus. Three dead bulls were found in Baker Creek Valley in April, 1944, and that spring Indians reported finding 'many' in the region about Nazko. Another report refers to a 'large number' of dead moose found in spring near Forestdale, which is near Bulkley Lake, and a third refers to 'about 50' found at Springhill, which is 15 miles north of Smithers. While the number reported may be exaggerated there is no doubt that a loss of moose from disease takes place annually.

The only information available here as to the possible cause of this mortality is contained in a statement prepared by Mr. J. D. Gregson, Dominion Entomological Laboratory, Department of Agriculture, Kamloops, British Columbia, and quoted here as follows:

"During the past ten years a disease has been noted among moose and deer in Northern Canada. In 1934 carcasses of moose, dead from some disease, were seen in numbers up to six per half mile in North Western Alberta. Deer in Northern British Columbia have often been reported to be in a condition unfit to eat. Since both deer and moose are nearly always heavily infested with ticks (D. albipictus) it is probable that these ticks are the vectors of such a disease.

"Other reports on file include the dying of several moose at Quesnel in April, 1939. These animals were so tame that they wandered into the streets of Quesnel before dying. Game Warden Mottishaw wrote that 'the moose were thin, but not in such condition that death was due to starvation. They were covered with ticks.' Examination by this laboratory of the carcasses revealed that the moose had died before the bulk of the ticks had engorged, so that death from tick paralysis seemed unlikely. More possibly it was due to either a primary toxin secreted by the engorging ticks or to some secondary toxin resulting from bacterial infection. Another record is that of a dead moose examined by us at Tatla Lake. This carcass again was covered with *D. albipictus* ticks. Reports are also often received from Cariboo ranchers who state that deer and moose are so heavily infested with ticks in the winter that wherever they lie down the snow is stained red with blood. In no instance have we isolated any pathogenic bacterium from moose ticks, although in several instances we have observed bacteria within the guts of ticks. Whether or not these organisms are associated with the disease we are not in a position to say.

"Considerable research work has been done on moose diseases in the States. Dr. Fenstermacher, in his studies on a moose disease in Minnesota (Further Studies of Disease of Moose, University of Minnesota Agricultural Experiment Station, Bul. No. 397, 1934), implies that there may be more than one disease responsible for the sickness among moose. I quote from him: 'Contrary to reports by Cahn and his associates, paralysis has never been noted as a symptom in the moose we have observed ... We were unable to isolate any pathogenic organism from ticks from diseased moose by bacteriological examination, whereas Cahn reports strikingly different results: 'A bacterium, *Klebsiella paralytica*, has been isolated from ticks of this species taken from diseased moose... This organism, when injected into animals, has produced symptoms similar to those in tick-infested animals and in the diseased moose. In practically every case the injection of *Klebsiella* has proved fatal. It has been demonstrated that *Klebsiella paralytica* produces a highly potent toxic substance, which when injected into animals, produces results identical with those obtained by culture innoculations.'"

The social developments resulting from the moose invasion are of exceptional interest and incalculable value. Moose now provide a meat supply easily available to settlers and to Indians, and, because of this, there probably has been less hunting pressure on the decreasing herds of caribou. (The Provincial 'Game Act' provides that Indians may kill male animals of the deer family for food at any time.) Finally the abundance of moose provides a form of hunting within the means and ability of a large class of tourists to whom the hardships in connection with the more specialized and more expensive hunting of sheep, goat, caribou, and grizzly bear have little attraction. It is difficult to measure the amount of indirect revenue that accrues to the Province from this resource. It is known to be substantial and there is no reason to doubt it can be expanded.

Woodland Caribou--Rangifer montanus Seton-Thompson.

In southern British Columbia caribou herds commenced to decline in numbers between 40 and 50 years ago. As early as the first decade of the century some ranges, formerly frequented by a considerable number of animals, were found to be deserted. This was so in a section of alpine summit east of Vernon known as the Harris Creek plateau. History would seem to be repeating itself in some parts of central British Columbia. While the general picture there seems to be one of gradual deterioration, reports indicate that on some ranges the decrease has been checked and herds are building up again. This is attributed to the fact that since moose have become abundant in the lowlands, Indians no longer climb the mountains to hunt caribou.

The disappearance of caribou from the Harris Creek Plateau 40 years ago was held to be a result of cougar predation; further north, where a decline of population has become obvious, it is attributed to the comparatively recent invasion of wolves. This is an over-simplification of a complex problem. There would seem to be other more potent adverse factors involved, but just what these may be is not fully understood. The killing of caribou in the way of sport is probably not a factor. There is a season limit of one bull to each hunter and the older bulls are sought for. The total number killed during the past four years by tourist hunters is 410. To what extent this total would be increased by adding the number killed by resident hunters and the number killed for food is not known, even approximately. The number killed by licensed hunters has declined each year for the past five years. The total number of licensed hunters in all categories has not declined correspondingly, as might be expected because of war time conditions, indeed the numbers show a slight increase in the past three years, viz.; from 2,338 in 1940 to 2,497 in 1942. However, as only relatively few of the hunters licensed to hunt big game would be likely to hunt caribou, the figures have little significance.

Caribou killed by Non-Resident Hunters

1939	1940	1941	1942
139	108	91	72

Because of the pressure of other duties I was unable to visit any of the caribou ranges. The information submitted hereafter was obtained by personal interviews and through correspondence with persons familiar with the history of caribou in central British Columbia. These sources are acknowledge, and the regions to which they refer are indicated in the text.

Region 1: Northeast of Barkerville, east of Willow River; comprising an area roughly 25 × 15 miles adjacent to Narrow Lake and the headwaters of Haggen Creek

All information relating to this region and the next was supplied by Mr J D Cochran of Barkerville, who has trapped, guided and prospected in this region for the past 32 years. Mr Cochran is known to be a careful observer of wildlife; he has photographed caribou and other mountain wildlife with exceptionally good results--some of his pictures have rarely been equalled--and his reputation as a guide is of the highest He is familiar with the country in question, not only in the hunting season but in summer and in winter also as his trap line traverses it

Cochran describes this territory as exceptionally suitable for caribou; within its boundaries are five licks, one of which, first discovered in 1914 is of large size. Fourteen years ago the population was estimated to number between 60 and 75. About 1930, in July, he counted 45 caribou in the immediate vicinity of the big lick, and in January 1931 on the southern part of the range, he counted 53 in one herd. The animals were in the open and the count was made from a height above them This was an exceptionally large number of caribou to be together, the largest number Cochran had ever seen; the usual bunch contains about seven to twenty animals.

Sometime later the population began to decline, slowly at first, more rapidly since 1940 At present not more than four or five caribou, old bulls and cows, are on the range This estimate is based chiefly on the amount of sign observed during both summer and winter, and the fact that not more than two animals have been seen together at any time during the past five years. One bull, the last recorded, was observed near Narrow Lake late in August, 1943 No cows with calves have been seen in several years In the autumn of 1944 none of the lakes visited had tracks about them; no tracks were seen in the snow and the old, deeply worn trails were grown over

Mr Cochran belives that the caribou may have been killed or driven out by wolves. He has seen wolves chasing them and seen places where they were caught. He believes that cows and calves are the chief prey In the spring when cows are heavy with calf some that have been pursued by wolves, and have escaped after a long chase, may lose their calves as a result of the prolonged exertion

Mr. Cochran comments further that licks are important centres in a caribou range From the time these places thaw out in spring until they freeze in autumn licks are visited at intervals of from four to ten days Sometimes the caribou stay for several hours lying down or just loafing. Mention is made of a particular 'muley' bull, seen first at one lick, later in the summer at another 20 miles distant, and still later, in the autumn, at the first lick. While the animals cover a lot of ground in their travels, they always follow much the same course and return to the same area both winter and summer. The entire life of an individual is spent within a radius of 50 miles, so this observer believes.

Region 2: Southeast of Barkerville, Snowshoe Plateau to Caribou Lake

According to Mr. Cochran the caribou population of this region diminished at about the same time and to about the same extent as did the population northeast of Barkerville.

Region 3: Plateau between Torpy River and Raging River, north of the Fraser River between 121° and 122° W.L.

The following information was supplied by Mr. J. B. Hooker, guide and trapper at Dome Creek. The summer range for caribou is the plateau referred to above; the winter range comprises the benches along both sides of the Torpy River; the meadows along this river are favourite feeding places, particularly in spring. the population has become greatly reduced during the past ten years, a condition ascribed to wolf predation. During a hunting trip over the plateau in the autumn of 1943 only four young bulls, three cows and one calf, and the tracks of several others, including those of one old bull, were seen. In May, 1944, a total of 18 animals was counted along the Torpy River. Winter food is said to be largely 'caribou moss' Usnea sp.

Region 4: Plateau country on Wells, Michel and Chief Mountains south of Ootsa Lake in Tweedsmuir Park

The information covering this region was furnished by Mr. W. McNeil, guide and trapper at Ootsa Lake. The present population is approximately 300; it is decreasing because of wolf predation on calves. In winter the caribou feed on lichens on those slopes near the summit which the winds keep bare of snow. In summer the population frequents the foothills and the lower benches. It was the custom of local Indians to hunt caribou regularly each winter on the plateau, but, since moose have become plentiful, they no longer do so. Mr. Jacob Henkel told me that 30 to 40 years ago caribou used to come down to Francois Lake in winter and that he has shot them there.

Region 5: Bulkley 'Telkwa' Mountains between the Bulkley and Skeena Rivers and between 127° and 128° W.L.

The information submitted was supplied by Mr. C. D. Muirhead who obtained it from various sources that are considered reliable. This region includes an extensive plateau country, some 30 miles in length, west of Telkwa at the headwaters of the Telkwa River and its tributaries. It is relatively inaccessible and visited by relatively few hunting parties. In 1943 the caribou population was estimated to be 250. The opinion that an increase has taken place during the past 15 years seems to be general amongst the few people familiar with the region. In winter the caribou travel in fairly large bands, feeding on 'caribou moss' in the alpine fir forests at timberline, and on lichens growing on the open mountain slopes which are kept bare of snow by the prevailing winds. About the time of the first spring thaw in April the herds disperse and part of the population moves down the slopes, some animals going as far as the lower valleys. Here a few may remain as late as July. There follows a gradual movement upward and by September most of the population is again on the alplands.

Some of the older Indians told Muirhead about large bands of caribou that, approximately 60 years ago, used to cross the Bulkley River. One Indian told of seeing a band of 150 at one of the crossings, the site of the present village of Telkwa.

Region 6: Between the Omineca River and Nation River. A plateau country in this region is reported to be both summer and winter range for a caribou population of unknown proportions. It was referred to by various persons with whom I talked, including Mr. P. Brown, Vanderhoof, but no precise information was obtained.

Region 7: There are extensive caribou ranges west of Moricetown and northward beyond the Babine River. No information was obtained in regard to the status of the herds reported to inhabit this region.

Dall Sheep--Ovis dalli (Nelson).

A female mountain sheep, said to have been one of a band of six, was shot by an Indian on Hudson Bay Mountain about 1932. None has since been reported from this region. The mounted head and the hide of this animal is in the possession of Mr. J. B. Langston. It is identified provisionally as Ovis dalli stonei (Allen).

Mountain Goat--Oreamnos americanus (Blainville).

Mountain goat still inhabit the upper portions of Hudson Bay Mountain, the base of which is three miles northwest of Smithers. Goat are reported also from many mountains on both sides of the Bulkley River Valley; the mountains east of Clore River are said to contain a large population.

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THE TRAPPING INDUSTRY AND FUR-FARMING

The trapping of fur-bearing animals in central British Columbia, once the sole industry there and the reason for the country's exploration, continues to be one of the chief industries. It is a full-time occupation for a large number of persons and a source of revenue to many settlers who might otherwise have difficulty in making a livelihood. Currenly there are 1,892 whites and approximately 2,880 Indians possessed of registered trap lines in the Province.

The value of the fur catch during the period 1935-36 to 1942-43 was $11,216,870; the amount of the royalties collected by the British Columbia Government during the period 1935 to 1942 was $404,769. British Columbia is sixth amongst the Provinces in the production of fur.

It is not known whether the number of persons trapping in the last few years is greater or smaller than the number trapping prior to the war. One might expect that in war time a man-power shortage would reduce the number of trap lines in operation, and that the pressure on fur-bearing animals would be reduced to the same extent. Recent high prices for fur probably offset this tendency, to some extent at least, and some trap lines that otherwise might have lain fallow are being operated on a share or rental basis.

A system of trap line registration introduced in 1925 undoubtedly has produced satisfactory results in connection with the administration of the fur resources, and in the matter of relations amongst the trappers. It has enabled officials to settle amicably the numerous disputes that arose over trap line boundaries. Disputes became less frequent when a plan of allotting blocks of territory superseded the original one of registering linear trap lines. Undoubtedly trap line registration is an important conservation measure that will return increased dividends as time goes on and the education of trappers proceeds. However, to say that the measure has translated the trapper into a fur farmer intent upon maintaining adequate breeding stock on his trap line seems overly enthusiastic. Some trappers of course are and do, others obviously are not and do not. The trappers represent a cross-section of humanity manifesting different degrees of industry, honesty and intelligence; the acquisition of a trap line does not necessarily increase a man's endowment of these characteristics. On the contrary, it is found that management on the trap line is applied, or is not applied, in accord with the extent of the individual's interest and intelligence. This becomes particularly apparent in connection with the trapping and conservation of beaver, a species amenable to management as has been stated. There are outstanding examples of successful beaver management, one of which is presented with some detail in another section of this report. There are examples also of indifference to anything except an immediate profit.

Comparisons of the present supply of fur-bearing animals with that of 20 odd years ago as determined on the basis provided by royalty figures is not altogether satisfactory. It must take into consideration, for each period, such variables as the numbers of trappers employed, price fluctuations that influence the extent to which certain species are trapped, and the cyclic pattern of scarcity and abundance. Furthermore a relatively large number of beaver, foxes, marten and other fur, trapped in the northeastern part of the Province, were shipped to Alberta and are not included in the yearly records. Nevertheless fur royalty returns provide the only figures available at this time and these have been used in the following comparison of abundance in connection with five important species during two five-year periods, viz.; 1922 to 1926 and 1939 to 1943.

TABLE XII

Total of Pelts on which Royalties were Paid

	1922-1926	1939-1943	Per cent
Beaver	119,899	96,030	19.90 decrease
Fisher	3,300	3,416	3.51 increase
Lynx	24,089	6,539	72.85 decrease
Marten	51,459	42,807	16.81 decrease
Muskrat	474,434	503,471	6.12 increase

It will be observed that these figures indicate a decrease of beaver, lynx and marten, a slight increase of fisher and a greater increase of muskrat. The decrease of lynx and marten can be attributed, in part at least, to cyclic influence; the increase in muskrat is probably due to an increased demand for this fur and to more intensive trapping.

TABLE XIII

Total Yearly Fur Returns from Sixty-Two Trappers in Quesnel Game District

1938-39 to 1942-43

Species	1938-39	1939-40	1940-41	1941-42	1942-43	Totals
BEAVER	190	249	373	293	211	1316
MINK	44	159	83	105	83	474
MUSKRAT	1387	1346	1781	1628	1006	7148
WEASEL	799	1310	1102	1098	403	4712
FISHER	18	26	22	23	14	103
FOX	29	45	40	22	31	167
LYNX	20	29	15	23	24	111
MARTEN	82	157	128	157	92	616
OTTER	3	5	9	8	5	30
SKUNK	1	2	26	2	1	32
COYOTE	72	96	45	90	139	442
SQUIRREL	377	2886	2356	2966	1752	10,337

More precise information is available concering the amount of fur taken during the past five-year period in one locality, viz.; the Quesnel Game District. The details are set forth in Table No. XIII.

Comparison of royalty figures over an uninterrupted period of years does provide a picture of population trends. It is to be noted that these figures cover the royalties paid on fur taken in all parts of the Province except the northeastern portion. The population curves in connection with five important species are shown graphically (Fig. 42-44). Fox and mink have been omitted because the royalty figures for these species include both wild and ranch-bred animals.

Farming of mink and foxes has greatly increased the supply of these furs; the totals pelted in 1942 being 1,845 foxes and 32,144 mink. The industry is established in central British Columbia and although there have been some failures these would seem to have been due to inexperience and lack of proper management rather than to any adverse factors operating in this part of the Province. The industry could profitably be expanded and perhaps is one that will prove attractive to some returned soldiers.

Fur farmers use quantities of fish to feed their stock and are authorized by permit to obtain fish by netting. It has been observed that many northern lakes contain large populations of such fishes as squawfish and suckers that at present are of little economic value; the possibility of netting and processing these species in sufficient quantities to meet part of the needs of fur farmers might be studied.

The figures showing the monetary value of the fur catch were supplied by the Dominion Bureau of Statistics, other statistics are taken from the annual reports and files of the British Columbia Game Commission. Unless otherwise stated the data apply to the Province as a whole. In considering their value in a more limited application, i.e., to the region covered by the present paper, it is to be noted that the larger proportion of the fur crop is harvested in the central and northern sections of the Province.

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